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***USSR: Engineering &
Equipment***

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SCIENCE & TECHNOLOGY

USSR: ENGINEERING & EQUIPMENT

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MINTYAZMASH'S MANAGEMENT, RETOOLING POLICIES DISCUSSED

Moscow IZVESTIYA in Russian 16, 17, 18, 19, 20, Dec

[Series of articles by IZVESTIYA correspondents M. Berger, A. Druzenko and V. Romanyuk: "19 Kalinin Prospekt: Letters from the Ministry"]

Management Attitudes, Red Tape

[16 Dec 86 p 2]

[Text] A MEETING OF THE COLLEGIUM

On Saturday, 18 October, the ministry's corridors had been buzzing with people since early morning. A major meeting was being held.

There was a sign over the room's door: "Meeting in Progress. Question No." This time there was no number shown.

This is a special collegium and there is only one question.

A month earlier a party meeting in the Krasnodar Kray had given the Mintyazhmash's [Ministry of Heavy and Transport Machine Building] activities an evaluation that literally called for sober reflection and decisions on the part of its workers and managers. How could it be otherwise when the talk around the nation is that the ministry is a seat of conservatism and that the branch's personnel have a poor command of the new management techniques?

Minister S. A. Afanasyev began his speech to the ministry collegium with those unbiased words and a tense silence immediately spread throughout the hall.

What followed was not a traditional report but rather reflections expressed out loud. From time to time the minister pressed buttons mounted on the rostrum, the room lights dimmed and the rear wall turned into a screen on which slides of tables and diagrams were projected. Everyone looked at the numbers and charts which seemed to cause obvious surprise among the participants. Even the minister, having paused to allow the others to study and adjust to the information, interjected, "Look at what is happening to us!"

This was followed by what must be called extremely critical and self-critical comments. What else could be expected when every table of indicators appearing on the screen reflected not optimism but the reverse.

Meanwhile, the topic turned to the branch's key, critical and substantial effect on the pace of scientific and technological progress, as well as on the acceleration of this pace. Like so many others, the branch does not have any counterparts with all the pluses and minuses that derive from such a relationship. No one else is responsible for the products with which the branch is entrusted (one-of-a-kind rolling mills and presses, drilling rigs, excavators, diesel locomotives and railroad cars). Therefore, our economy's condition is adversely affected by the fact that in the first six months of this year 68 percent of the ministry's enterprises did not fulfill planned deliveries (the figure was 44 percent in 1984, when the branch was undergoing a broad-reaching economic experiment). The qualitative indicators have also worsened. While 15 percent of the enterprises failed to meet their labor productivity increase assignments two years ago, 27 percent have failed to do so in the first half of this year. The corresponding numbers for lowering production costs are 7 and 33 percent and those for revenue are 10 and 31 percent.

The two-and-a-half hour report ended and was followed by several hours of tumult. We never lost the feeling that we were watching a dispatch office rather than a meeting discussing branch management strategy. Sergey Aleksandrovich Afanasyev knew the situation at each factory, stepped into each question, gave his evaluation to everyone, repeatedly rose from his seat and conducted a dialog with nearly every speaker and pressed many speakers. He gave practically every speaker a warning: "We need a plan!"

Meanwhile the agenda contained only one question, but it was a very important one: How to restructure and how to work in new ways. The much-needed conversation nevertheless hid the branch's current concerns. By the way, from time to time there was sporadic discussion of the bureaucratic style of management.

"I must state in no uncertain terms," said Uralmash's general director Igor Ivanovich Stroganov, "that some ministry decisions are impulsive in nature and often reach those responsible for execution only after their deadline has expired! At the same time strategic questions go unresolved. For the five-year plan we were given a production volume growth target of 33 percent and the product line plan was increased by 67 percent. Different offices approved different indicators and there was no link-up of these indicators."

Yevgeniy Aleksandrovich Motsegora, general director of another of the branch's giants, the Novokramatorsk Machine Building Factory, approached the problem from a somewhat different angle.

"The only thing demanded from us is a count! Commercial production counts, implementation counts, tonnage counts, item counts and ruble counts. Why? The user needs the end result and that is our machines."

But these are isolated remarks which touch upon the principles and style of management and which arose during the conversations about current production matters.

It would be unjustifiable to claim that ministry workers are not concerned with questions of the future. This is where, after considerable work, the branch's annual and five-year plans are formulated and agreed upon, where targeted and consolidated plans are developed and where the limits of enterprise technological re-equipment are planned. All of these plans require the developers to work with an eye to the future. Nevertheless, today more attention and efforts are devoted to the resolution of current problems. The overall perspective becomes an object of analysis and attention only it is shifted from the future to the present.

There was a hope that a decision of the collegium would cause a shift of emphasis. In fact, ministry tasks for increasing management efficiency in the future were mapped out in the main body of the decision. Later, however, in the appendix where specific measures and actions were taken up, everything reverted to the familiar circle. The first, and thus the most important, point was the establishment of assignments for fulfillment of the fourth-quarter plan. Of course, there was a point about a change in style but, notably, it was item number 10.

The meeting of the collegium seemed to us to reflect the typical characteristics of a disease of modern managers (not confined just to those working in the Mintyazhmash); they are obsessed by the present.

THE THIRD TIER OF A TWO-TIER SYSTEM?

The ministry's bureaucracy functions within a defined structure. Until recently, two types of subunits predominated in this structure. The first consists of functional management administrations (economic planning, labor and wages, capital construction, equipment, finance, and personnel and educational institution management) which encompassed the entire branch, although each operated within its own expertise. The second type consists of specialized offices in charge of individual subsectors.

It is a conventional structure and we speak often and persistently about the need for improving it. It must be emphasized that we are improving it. The decision to change branch management to a two-tier system can be listed among the revolutionary measures. Just what does this mean? Specialized offices such as the All-Union Industrial Associations (VPOs) have played their role in the development of branch complexes. But they have outlived their usefulness today as the lower level has become stronger. A decision was made to eliminate them and link the enterprises and production associations directly to the ministry and its functional management administrations.

How has this revolutionary measure been implemented at the Mintyazhmash? Half-heartedly until now.

Some of the VPOs have actually been dissolved. Three, to be exact: Soyuzmetallurgmash, Soyuzteplovvozputmash and Spetstekhnologiya. The

enterprises formerly under these associations are now being managed according to the two-tier system, but not all of them. There used to be a total of seven such enterprises in the branch, now there are 21. A three-fold increase! This would seem to be significant growth, but let's not rush to conclusions.

The truth is that the ministry has four specialized central boards operating according to the old method: Glavgormash, Glavpodyemtransmash, Glavvagon and Glavdizel. Of course, we were assured that their functions have changed in comparison to the former VPO structure. How? Well, they explained, only in that material and equipment supply, finance and some other functions had been transferred to the functional management administrations while the central boards, they say, are only left with operational control over production and technical policy. But whether you call the subunit an all-union industrial association or a central board, if it has operational authority and can affect the future it constitutes yet another (a third?) tier of a two-tier system. Furthermore, two-thirds of the branch's enterprises and production associations are still subordinated to central boards.

Characteristically, it seems the ministry and its economic planning administration have developed a plan for switching the branch to the full two-tier system, but the plan remains in draft form. Why?

"They're used to working with the central boards," explained Lyubov Anatolyevna Busyatskaya, chief of the economic planning administration. "That's why the former structure is still in place."

Habit is certainly a powerful factor, but there is more to the situation. In our opinion the ministry is retaining the central boards in the two-tier structure because it does not want to release some of the reins of power to the enterprises.

This management "stinginess" is becoming a drawback because the bureaucracy's work is unintentionally being shifted to a short-sighted outlook more suited to solving operational questions rather than strategic ones.

ACCELERATION AND THE FLOW OF PAPERWORK

Just as any "polite" conversation seldom avoids the topic of the weather, it is a rare business discussion that does not touch the subject of paper; paper is overwhelming, annoying and stifling.

It is a perpetual theme.

Nearly 60 years ago Sergo Ordzhonikidze spoke, passionately as usual, of the fondness managers have for creating paperwork. Bringing up the example of the Mossukno Trust's accounts which occupied 13 volumes and 7354 pages, he said, "It's not enough that people write, make fools of themselves, grow stupid and themselves don't understand what they write, we are not in a position to sort out what is written in [these documents]... it all comes down to the fact that man is engaging in correspondence with himself."

Now today a leading collegium almost repeats the exact same words. In the ministry on the eve of the collegium meeting there was an analysis of the nature of internal memoranda which revealed some curious facts. For example, on the day the analysis was conducted the deputy chief of the main production administration informed the personnel administration in writing of his objection to the collection of administrative fines from the managers of some enterprises. The chief engineer of Glavgornash immediately sent letters with an appendix and references, amounting to 19 pages, to two central board chiefs. The subject: fulfillment of specific consolidated programs. How can we fail to understand the minister when he indignantly points out: "Soon they'll start writing to each other when they're in the same office."

It is a surprising paradox: everyone seems to agree that the creation of paperwork must be ended once and for all, but nevertheless the almighty document continues to rule unchecked and remains invulnerable.

In August the Central Statistical Administration examined the use of illegal accounting techniques at 30 Mintyazhmash enterprises. Some 135 forms were found to be in violation of established standards (they contained 140,000 indicators!). Investigators at one of the factories found 57 thousand indications of improper accounts which were nevertheless accurately represented during the year.

This is the situation at the ministry. The paper flow in a single main administration for design and capital construction for seven months this year (such a period has been adopted and there are monthly corrections for paper flow in each administration) consisted of 3365 incoming and 2020 outgoing documents. That means 70 central board workers had nearly 5500 "document units" to contend with. This is (actually this should be) in addition to their normal duties. Now, if we consider that at the same time these administration personnel participated in the preparation of 60 ministry decrees, 54 board decisions and 90 protocols it becomes clear that it must be difficult for ministry construction strategists to devote time to their primary jobs.

It cannot be said that the ministry is not struggling against the creation of paperwork. They are struggling! They issue directives, they punish those who request unnecessary reports as well as those who prepare these reports and they have even introduced a special inspection office to monitor the progress of the struggle. It cannot be said that this work is fruitless, but the insignificant partial nature of the results confirms the axiom that the problem cannot be solved by a single directive.

The problem is not simply that the workers are addicted to creating paperwork. The same virus has affected many of the ministry's associates. There is an enormous flow of surplus paperwork between the ministry, USSR Gosplan, the Ministry of Finance, the State Committee for Science and Technology and the USSR Council of Ministers' Bureau for Machine Building. Each department holds tightly to its set of indicators and the related paperwork bureaucracy.

According to estimates by Academician T. Zaslavskiy, 500 billion management operations take place annually in this country. To this we must add an equal number of monitoring operations. According to the system adopted, none of

these operations can take place without supporting paperwork in the form of accounts, memoranda, reports and the like. In other words, we must repeat, whatever type of war Mintyazhmash declares against excessive correspondence the best result that can be expected is partial success. The ministry is not able to fundamentally change the situation because it is operating in the national economy's uniform system of paper flow and it cannot truly isolate itself from that system.

Mastery of the wall of paperwork is only possible through a fundamental change in the system of management relationships. The creation of paperwork can only be eliminated by removing its cause. In other words, as long as the granting of extensive autonomy to enterprises remains only a dream, not even the strongest orders will stem the stream of paper flowing between these same enterprises and their ministries.

The cry heard everywhere today is that the final result is the most objective means of evaluating any type of work. But when this is applied to ministry workers we must first of all decide what is to be considered as their final result. Until such time as the results of sector operations and the decisions impacting on these operations replace the production of paperwork (including the query, the accounts, the draft, the order and the summary, etc.) as the standard of evaluation, the restructuring of work will mean turning pages and acceleration will mean accelerating the rate of document flow.

We repeat that there is much to be changed in the course of improving the mechanism of management. Such an improvement calls for fundamental changes in the nature and structure of management. In our opinion the new structures can be varied and can even take into account the differences between branches, as well as the principles of self-support in everything, including the maintenance of the management apparatus. As soon as the right to solve most questions is shifted to the lower level, the ministry headquarters, as the branch's guide to self-support, will be forced to change its attention to matters of strategy. This means that its day-to-day efforts at "maintaining" production will be minimized and that the plan of random pressure from above will end.

The shift from administrative to economic management methods is a complex and difficult process, but it is inevitable. Our next essay will cover its progress in heavy and transport machine building.

Planning, Costing Methods, Incentives

[17 Dec 86, p 2]

[Text.] A LINE FROM THE STENOGRAPHER'S RECORD

Many at the Mintyazhmash believe that the ministry's current reputation, which is less than shining, has influenced the USSR Supreme Soviet Preparatory Commission's consideration of the course of restructuring in the branch. We must note that the essence of the matter is not the nature of the discussion

but the nature of the restructuring or, to be more precise, the absence of restructuring. The commission came to the sharp conclusion that the branch's headquarters has not restructured itself in the required manner and that administrative methods clearly were dominant over economic methods.

We don't believe this came as a great surprise to ministry workers: they know where their errors are. But, as economic experiment pioneers they are used to more exacting evaluations. Negative results are unfamiliar, painful and bring forth objections. Here is a small but illustrative segment of the meeting record.

I. Aleksandrov, Deputy minister: The draft of the decision shows that Gintyazmash hasn't regularly brought new management principles into practice. We would like it to be worded as follows: "Gintyazmash is not yet introducing economic management methods in an adequate manner."

A. Gromyakov, Deputy chairman of the Council of the Union's Budget and Planning Commission: You mean you want to depart from strict wording?

I. Aleksandrov: Yes. We really have introduced new methods.

I. Veretennikov, All-Union Central Council of Trade Unions deputy department chief: I don't think it would be right to soften the language. We surveyed 10 of your enterprises to find out how well workers and specialists knew the new management methods. Every third person had a vague idea about them, while 10-15 percent knew nothing at all about them. A concept can only be understood if it becomes a part of one's knowledge. How can this happen if people aren't even aware of the principles?

S. Poryshov, Deputy: The new system was only been in operation in the branch for one year and then all the indicators fell.

L. Susyatskaya, chief of Gintyazmash's Economic Planning administration: You say the indicators fell, but our pace rose!

A. Gromyakov: We're getting the impression that Lyudov Anatolyevna [Susyatskaya] is not being completely objective in evaluating the ministry's situation. You don't have any movement, things are going along as before and the economic experiment is not being pushed forward.

We understand now and it is to hear such words. Gintyazmash personnel are the pioneers in this economic experiment and, in Susyatskaya's words, "have brought it into their hearts and minds." Many links in the new management system have been forged behind the ministry's walls and in its offices. These include means of establishing stable standards and asset allocation sizes, as well as methods for distributing rights and duties between branch headquarters and the enterprises.

The start was encouraging. A lot has actually changed at the enterprise level and there has been impressive movement toward satisfying contractual obligations.

When they jealously evaluate everything accomplished under the experiment in other branches, Mintyazhmash workers have no objection to once again pointing out their priority in this matter. No one is arguing, as they say, what was—was. The only thing is that the leader slowed down at some stage. Suddenly it became apparent that it was behind. Now many branches have converted to self-financing and self-support. Mintyazhmash is a member of the second group and will wait until 1988. Only three of the enterprises (Uralmash, Voronezh's Rudgermash and L'vov's Konveyer) will set out on the road to profitability in 1987.

"The new management conditions are supplemented with the principles of self-financing and self-support," Lyubov Anatolyevna Bisyatskaya tells us with animation in her voice.

"Can you imagine it? No budgetary assignments! No profit — not even charges against assets. We have miscalculated all sources of asset formation. On the whole, we are fully subscribed under the new management system's conditions.

"Nevertheless, the task of breaking the trend has been assigned to Mintyazhmash.

"Yes, the Sumyatskaya association is a living example of working in the self-financing mode."

To be sure, the economic experiment is no sports event. Those with special practical experience should be the ones to go forward. Everything that has been done in this area by Mintyazhmash specialists is not worthless by any means. This is what was learned by their neighbors on the Kalinin Prospekt, the Ministry of the Electrical Equipment Industry, and even earlier by the Ministry of Instrument Making, Automation Equipment and Control Systems and the Ministry of Chemical and Petroleum Machine Building. But time is passing; we must go further, more decisively and faster.

Lyubov Anatolyevna told the curious story of an article she wrote to appear in the *PLANNING (HOZKAYSTVO)* (Planned Management) magazine. While the article was being prepared for printing the problems it mentioned became superfluous, one after another. For instance, there was the need to reorganize the planning structure and make evaluations from the previous year's plan rather than from the level achieved. This structure was suddenly accepted in 1987. There was mention of the advantages of a standard planning method and this question has now been solved.

Of course, it's always easy to cut paragraphs out of an article. It's somewhat harder to shift stereotypical outlooks on matters. Moreover, those who maintain these stereotypical beliefs are not necessarily throwbacks. Sometimes the situations in which they must act permit no other way out. The experiment's strategic goal was one of motivating the enterprises to fulfill contractual obligations so that they would themselves establish tighter plans. The idea was to give them greater rights in planning, the use of incentives and in personnel matters. In actual practice, however, these rights have not been used successfully and there has been a marked reduction in the enthusiasm of those at the enterprises and in branch headquarters. This is probably

because as the boundaries of the experiment grew, the pioneers stopped receiving the "manna from heaven" in the form of metals and other materials initially distributed with a bright red ribbon labeled "Experiment." It's also possible that some thought that the experiment's principles, its economic tools, would operate automatically, something that, unfortunately, did not occur.

ITSELF IN TROUBLE

When evaluating the work of a factory, central board or branch we first consider the way in which the national economy's need for goods such as diesel locomotives, metal-cutting machine tools, diesel engines, cranes and the like are satisfied. Then we consider item or tonnage counts (we are used to counting even rolling mill production in tons; the more metal used, the better for the manufacturer). Now the criteria for production leaders include technology level indicators, service life, reliability and survivability. Only after all this do we address the sometimes rhetorical question of the cost of production.

What is the real cost? Once we change to self-financing and self-support this will be the leading criterion.

As we have already told the reader, we arrived at Mintyazhmash when it was far from being at its best. The entire branch's financial position has worsened. The revenue shortfall for the first six months of 1986 was 25 million rubles and at eight months the figure has climbed to 40 million rubles. The assignments for reducing production costs have not been fulfilled.

We discussed the problem with specialists from the production cost and revenue planning department. Experienced and knowledgeable people are hard at work here. Just like Ms. Busyatskaya, Yekaterina Yegorevna Razuvayeva, the department chief, has been working at the ministry for 20 years, since it was established. Many department workers have been through advanced production training.

With them we are trying to determine what has happened to production costs. Ye. Razuvayeva spreads her hands in a gesture of helplessness: although production cost is the mirror in which the work of all ministry services is reflected, her department has no effective means of influencing these services. All there can be is an analysis of non-productive losses. One factory had defective output, while another exceeded resource utilization standards; here the financial people miscalculated, while here there were excessive expenditures for the development of science and technology. Meanwhile the excess had been added to production costs.

To be sure, analysis is important. Without analysis one cannot reach a decision. What decisions were made in these cases? Again the amount of paperwork, orders and written and oral memoranda increased sharply. A number of directors, their deputies and chief accountants were called on the carpet. In the production cost and revenue planning department we were shown a bulging file containing copies of letters sent to various central boards of this very ministry. The content of the letters was nearly identical in each case:

production cost reduction assignments are not being fulfilled; high losses due to defective production; materials usage standards exceeded. The letters contained requests to establish supervision over the fulfillment of measures. Finally there was a demand: answer by a specific date. Where are the answers?

"We really didn't expect any," says Ye. Razuvayeva. "The important thing was to remind the central boards."

"What, they don't know?"

"They know, but there isn't any supervision."

"OK, but the situation has changed now, hasn't it?"

"All in all it hasn't. The main demand is to follow the plan. Not much importance is attached to our recommendations."

Incidentally, the planners do have effective tools, they are just being modest. The lowering of production costs is an asset-forming indicator: each one-percent reduction increases the material incentive fund by five percent. But when the plan heats up--and this happens quite often--economic management principles have to be cast aside. Let's consider the consistency indicator: nearly three-quarters of the branch's production has been accomplished in a third of a decade. An out-of-town collegium meeting was held in Voronezh to study the precisely planned ideal production rhythm of the Rudgormash Association. What changed after that? Almost nothing. In most enterprises the wheels of production hardly move at all during the first part of the month. By the end of the month there is a rush and each day sees a 2- to 3-fold overfulfillment of the plan. More often than not the numbers can be brought into correspondence with the plan, but at what cost? Also, rush production is paid for in reduced quality, improper resource utilization and increased production costs.

The economic responsibility mechanism is not coming into action. Instead, there are efforts to replace it with the customary voluntary methods which time and again result in low efficiency.

EVEN HEADQUARTERS DOESN'T HAVE THE POWER

Now factory directors and ministry leaders are both saying the same thing: they don't have enough power. Just what kind of power are they talking about? The directors mean the power to independently formulate a plan and distribute assets. The minister essentially has the same thing in mind, except at the branch level.

As the situation was set up by the party congress, the ministries must provide the economic, methodological and authoritative base so that the enterprises can operate independently (we emphasize, independently). They are obligated to actively assist the directors in formulating balanced plans and to supervise resource allocation to these latter. Once they have started to "earn" these resources, the enterprises are not always able to use them, especially on needs arising from restructuring. This is where the ministry's help is needed

and not one director refuses this kind of guardianship. Often, however, the ministry would like to help but can't. Why?

"The question of expanding enterprise power cannot be addressed without solving the problem of expanding the authority of the branch headquarters," answers L. Busyatskaya. "We admit we are criticized for the multiplicity of plan indicators. But we only plan those items envisioned by the new conditions: implementation, productivity, production costs and product lines. This is what our economic planning administration handles. There are another 60 indicators in the new equipment plan, 40 in the capital construction plan, 9 in environmental protection and 7 in the management system improvement section. The authorities communicate indicators to us and we naturally pass them on to the associations and factories."

"So, the ministry is a messenger."

"Our efforts to influence the situation are reflected by repeated references to the Council of Ministers and Gosplan."

"And what happened?"

"Nothing! They promised to reduce the number of product line indicators for 1987 from 396 to 242. We have received a plan draft which contains 53 items from the Council of Ministers and 305 from Gosplan! Everything is here: from how many diesel locomotive, railroad cars and diesels to the number of castings, forgings, die forgings, and so on. It makes no sense, why plan the intrabranch process stages which in the final analysis result in a finished product? But, discipline is discipline. We passed on more than 350 indicators to the enterprises and Gosplan is adding on another 600."

Why so many? Because Gosplan, Gosplan and the others will not monitor just those items which affect the national economy? It would be better to transfer all other items directly to the enterprises. This would be a true step toward expanding the independence of the lower level. However, Gosplan and Gosplan still actually formulate the plan and the ministry only monitors the fulfillment of assignments which are often unbalanced. No one except the enterprises is actually responsible for any departure from reality.

This year there was a 10-percent shortfall of rolled metal product in the production plan of the Voroshilovgrad Diesel Locomotive Building Association. Overtime alternated with downtime. The association repeatedly called this to the attention of Mintyazhmash, Gosplan and Gosplan, but there was no real improvement.

Attending the collegium meeting, I. Sukhov, the association's general director stated, "The plan is being fulfilled through a combination of indirect methods, overloaded capacity and, above all, the exhaustion of our production reserves. Measures were planned to save metal, but not one was implemented by ministry services because there was no time for them and they went against the plan."

But ministry workers do not operate in a vacuum. Their actions are also regulated by indicators, standards, statutes and instructions. For example, in violation of all provisions and principles of the new management system, the USSR Ministry of Finance continues to plan revenues and expenditures for all items. The authorities are not in a hurry to relinquish their powers and the ministry is also not rushing to do so.

Today we must recognize that nowhere in the economic experiment are there any elements of fundamental reform. Many central bureaucracies which determine the extent of the ministry's independence do not agree with the idea of even partial modernization of the existing management system. As a result, everything is still leading to a reinforcement of the poorer aspects of the management system. The restructuring has not affected planning and control methods and little has changed in the areas of materials and equipment supply, the financing and credit system and pricing.

As we have seen, even the basic condition of the experiment, the reduction of indicators planned from above, is not being followed. Now there is an especially important step facing the experiment, the mastery of the principles of self-financing and complete self-support. Mintyazhmash was given a year to prepare but time has flown. In all fairness we must repeat that overcoming the stereotypes is not entirely in the hands of the branch headquarters. The predicament is that our central management authorities, called upon to issue methodological instructions and to actually restructure our economic practices, are removing some stereotypes slowly. USSR Gosplan, the State Committee for Prices and the State Committee for Science and Technology continue to release a number of old-style directives. In other words, there hasn't been much of an experiment. Now who can guarantee that the principles of self-financing and self-support won't also be restrained by obsolete management methods.

Moreover, the fundamental economic reform referenced by the 27th CPSU Congress, which involves the lower level--the factory, shop and brigade--to a great extent--must influence the entire system of centralized, planned management. Under these conditions of releasing strict directives from above, there can be no demand for the introduction of economic management methods from below. Each level must bear its share of responsibility for profitability.

EQUIPMENT USAGE, OBSOLESCENCE, PRODUCTION

[18 Dec 86, p 2]

[Text] ATTENTION: OBSOLETE MACHINE!

We would like to start our discussion of equipment with a letter from V. Anikina, an engineer-instructor at the Pechora Locomotive Depot. He provides us with first-hand information from the Pechora Depot, a major facility for testing new equipment.

"First I must say," writes V. Anikin, "that today in this country we don't have a single locomotive that would fully satisfy modern demands. I remember the high hopes we had for the then-new 2TE 116 series. But the machine took so long to finish that the units now in series production are obsolete.

Right now at the depot we are conducting operational testing on a promising new diesel locomotive, the 2TE 121. This locomotive's traction characteristics exceed those of any series-produced locomotive, but its development history is repeating its predecessor's fate. Ten years have gone by and the unit is still "green." Measures are regularly adopted to fix shortcomings but there's no end in sight. Our pleas to Mintyazhmash and the Ministry of Railways have had no effect."

How much of what this engineer-instructor says is true? We will try to find out.

Three months ago, in writing about the lives of Voroshilovgrad locomotive builders we detailed the critical situation building at the enterprise. There was a real threat that the 2TE 10M locomotive, the basic line produced there, would lose its State Seal of Quality with all the consequences that derive from such a loss.

Unfortunately, this occurred. Not long ago the locomotive was reduced to the first category. This is "unfortunate," not because it deserved a better evaluation, but because our major rail authorities deserved a locomotive which wasn't just a good one satisfying worldwide standards but one which exceeded these standards.

Workers at Voroshilovgrad and their ministry colleagues until recently believed in their aging creation. The sharp "no" from Gosstandart was a painful but customary blow to Mintyazhmash. Recently the mark of the highest category has fallen off branch products like leaves from a tree on a windy autumn day. In the last year alone, 76 types of products lost the seal. Sooner or later you stop smarting and begin to adopt a philosophical outlook: that's the way it is in manufacturing so they say.

Furthermore, although a bad situation, it's easy to explain when machines which were once progressive become obsolete. It is hard to explain new products slated for production which do not satisfy current demands. Last year only 5 of 49 branch products meet the standards of the highest quality category. If this is a technology policy, what is it trying to achieve?

The ministry's plans call for bringing 90 percent of its production output up to worldwide standards during the five-year plan period. This is a more than grandiose plan if you consider that 58 percent of the mineral recovery machines, half of the lifting and hauling machines and none of petroleum drilling rigs meet worldwide standards at this time. To understand the extent of the goal planned we probably need to study the mistakes of the past, including the history of 2TE 10M locomotive.

It was placed on line in the early 1960s when it compared favorably to its predecessors in terms of power and economy. But a machine becomes obsolete in

less time than needed for a child to reach adulthood. That's probably why its age is easier to ignore, there are no wrinkles and no sickness and none of the other signs of aging are present.

One of the reasons for the problem with the locomotive is, as we have stated, is the lulling effect of steady demand. No one else makes this type of equipment. Therefore, our range of selection is similar to that in the familiar joke in which God introduced Eve to Adam and said, "Choose yourself a wife." There is yet another reason why the Ministry of Railways is attached to the old locomotive. It has been used for many years and there a large number of repair facilities devoted to this common locomotive. In short, internally the affected parties are not interested in renewal. This fostered the ideal conditions for the locomotive's obsolescence.

Let us recall the essence of the Voroshilovgrad workers' message: give us another diesel and we'll build a higher quality unit! The persistence with which this argument is advanced is based on the fact that the 2TE 10M's diesels come from a factory under another ministry. Nothing affects us as fundamentally and as irreconcilably as the behavior of our associates.

How does the situation look from this tall building on Kalinin Prospekt? An attempt at summarizing everything heard about this matter would look something like this.

CAUTIOUS OPTIMISM

They tell us, of course they are wholeheartedly in agreement with the responsible task entrusted to them and that in the next five-year plan they will switch to series production of the modern 2TE 121 locomotive, but there is a serious lack of capacity for producing new diesels and for manufacturing the new locomotives themselves. The capacity is not growing satisfactorily at this time and this is a reason for concern.

We must note that these words are most often heard in parts and from various people. The higher the position, the greater the optimism, while the alarm and doubt grow as you get closer to the factory. E. Vasilyev, deputy chief of the ministry's main technology administration, assured us that the program for manufacturing the new units would be fulfilled and even exceeded. On the other hand, V. Tsyganok, the association's party committee secretary, explained that the switch to series production of the new locomotives would take 15-20 years at the current pace of preparation. The ministry departments, always hoping for the best, are located somewhere between these two extremes but meanwhile they share the concern of those at Voroshilovgrad.

The different positions are not explained so much by personality or knowledge as by differences in duties. E. Vasilyev, directly responsible for the technical level of locomotive building, simply cannot doubt the future of 2TE 121 production--duty requires him to believe in the future support and current hopes of the branch.

"Here is the exact program," says Eduard Fedorovich [Vasilyev] as he hands us folders of orders and decisions. The overfulfillment and catch up are all

there, but they are "shifted to the right," toward the end of this five-year plan and the beginning of the next, and if something is not done it might even exceed the latter period.

Why must an innovation travel such an arduous and prolonged path and why does a machine become obsolete before it is in mass production? This is what V. Anikin, the engineer-instructor we met above, has to say: "It is clear from my discussions with designers that they don't care whether they are working on new or old equipment. The interest is identical--that is, totally absent. Myself, I would have a contest to see who could develop the new locomotive fastest, with the best quality and most economically. There would be no skimping on the prize. Half the cost of an unreliable locomotive expended on specific incentives would more than pay for making all the rest reliable."

In our opinion, Viktor Mikhaylovich [Anikin] underscored the most important point, that of economic disinterest in the development and manufacture of new equipment.

Today the most important incentive criterion and the fundamental means of praising, reproaching or reaching conclusions about an organization is the quantity of items which have already been placed on stream. Efforts are being liberally expended to that end even today. The good intentions and infinite pains involved with a new technology are unreliable stimuli. Furthermore, let us repeat that there is no competition pushing the innovation forward, no need to surpass anyone and no need to fight for customers.

For instance, what work do the Mintyazhmash workers responsible for new equipment production actually perform? The Diesel Main Administration's chief designer, A. Popov, like five of his colleagues in the experimental design department, doesn't conduct any experiments and doesn't design anything. Their main function is coordinating the efforts of designers, factories and the ministry itself. In practical terms, coordination means handling paperwork, conducting meetings and clarifying various types of information on the performance of plans involving new equipment, etc. In other words, the chief designer is involved only in an ongoing process of correcting problems rather than supervision. Time and effort are expended on oral and written pushing of factories, factories, institutes and their departments.

"Ten new machines were developed during the last five-year plan," says Anatoliy Mikhaylovich [Popov], "but we can't put a single one into production." "Our factory at Khabarovsk built a new diesel with features that surpass the current model. Building these at a rate of a few per year without special equipment and facilities is what we call 'working on our knees.' There are hardly enough resources to produce the series line which no one will allow us to sacrifice. The situation is the same at nearly all diesel production facilities."

So it seems that today's problems are holding up the future. A chief designer cannot control the technology policy because he is without effective tools for such action and has no real power, either administrative or managerial. Therefore, there is nothing to do but carry out current instructions and monitor their fulfillment.

Of course, Anatoliy Mikhaylovich [Popov] has strategic considerations. For example, he is not certain that all equipment has to satisfy the highest world standards.

"World standards, OK," says A. Popov, "but the highest standards? That's an economic luxury. In themselves, the world standards include a wide range of characteristics developed for different users and various operating conditions. A messenger carrying a telegram doesn't need a fountain pen with a gold tip, a pencil will do. Maybe that's not the best analogy but orienting ourselves exclusively to the highest world standards will force us to produce only 'gold pen' equipment. I don't think this is always justified. We produce the simple Andizhanetsh diesel here and it can be used by anybody anywhere. It doesn't satisfy any world standard and isn't contained in any All-Union State Standard, but people buy it from us with currency."

It's possible that A. Popov is right to some extent. But doesn't that kind of outlook set up a sort of complacency in the face of current obstacles which are complicating the situation with objective and other factors?

Let's take the engine, that primary cause of trouble in the locomotive. We must say that the ministry's current "severe diesel shortage" is to a great extent the result of a single widely publicized technical "demise" which never occurred. In the 1930s a group of scientists managed to prove that piston-engine construction was in its decline and gas turbines would be the engines of the future. Probably at a time when unspoken, final decisions were especially in fashion it seemed impossible to allow parallel development in two different directions. When Anatoliy Mikhaylovich Popov entered the internal-combustion engine department of a polytechnical institute before the war, he was strongly persuaded not to devote his life to a passing technology. It took a decade to convince everyone that the situation was not as presented. Major efforts at catching up weren't made until the first half of the 1960s. But everyone knows that waiting and catching up is better than not. In other words there were serious consequences for this ministry. The ministry is trying to overcome these difficulties rooted in the past, if not in history itself, by various means.

In the meantime the branch's work (and remember it has no counterpart) is being evaluated not so much by the consumer as by its supervisory entities. To the best extent of its capabilities the ministry is trying to influence the development of monitoring criteria. If the capacity to rise to a given level is not there, the easiest approach is to lower the slope a little.

Four of the five series-produced locomotives and three out of the five diesel engines do not satisfy the highest world standard. And this is in a situation where the ministry developed a rather preferential set of evaluation points.

A new system of standards is being created today. Half of all the drafts prepared by Mintyazhmash recently have figures lower than those established by the government. The All-Union State Standards often incorporate numbers which are lower than the world standard at the beginning of the 1980s. This is not just a situation at the branch headquarters. Not long ago many ministry enterprises seriously put forth the question of their inability to introduce

state acceptance standards. The state acceptance standard is becoming a reality, even though the enterprises generally know what it threatens them with.

EVERYDAY NEEDS REQUIRE SACRIFICE

Perspective and the future: these are ephemeral but current concepts. The important thing is that which is done today.

We treat the future like our health. Everyone knows things which need to be taken care of, but everyone puts them off until later.

Everyday production and management needs trample perspective and subordinate it to their interests. The fate of an experimental shop at the Voroshilovgrad association is indicative of this. Up to now it has been identified by a sign with the words "Experimental Shop." When the ministry's chief locomotive design engineer V. Antonov (who, like his colleague A. Popov, controls and manages rather than designs) started to work at the association the shop actually did the work it was intended to do. Sure, it was 1960. Then came the attack on the experimental base. First consumer goods production was moved there--in the form of school desks--then one of the current production operations moved in. Now there is only a single section of the shop that can be considered experimental in nature.

Now that the association is faced with the unprecedented question of renewing and improving the product line, the people at Voroshilovgrad are without experimentation facilities.

"It wouldn't hurt the factory to have a place where prototype components and even a prototype locomotive could be built under good conditions," says V. Antonov.

The idea is a good one and it comes from a knowledgeable man. What's the problem? There are orders relieving the experimental shop from outside duties but they are being resisted with an enviable stubbornness.

The chief of the metallurgy and specialized production process equipment main administration, V. Yerokhin, recently visited the association and was somewhat amazed to see that the tool shop was producing consumer goods and some lines of small goods instead of tools.

Traditionally, the main focus of attention has been on assembly, i.e. on those directly involved with the final product. Concern about tools, accessories and even foundry production has always been shifted aside. The management that overlooked those items was the one which got production going.

This outlook did not develop without the ministry's participation and is widespread even today. Plant management was asked to prepare suggestions for improving pre-production engineering. Three times the drafts were considered

unsatisfactory. Why? They had no perspective and without a feeling for perspective there can be no scientific and technological progress.

Those at Voroshilovgrad and those at Mintyaznmash believe that the modern and powerful 2Tz 121 locomotives will still take their place in the nation's locomotive fleet. The only questions remaining are when they will arrive and how reliable they will be.

While familiarizing ourselves with the ministry's products we were surprised by the various contrasts. On the one hand there is unique equipment while on the other hand there are machines which will be refused by customers any day now because of their low level of technology.

The Novolipetsk metallurgical facility has a mill which produces 6.5 million tons of rolled product per year and has no equal in the world. The Novokramator Machine Building Factory is now producing a 45 thousand-ton press. Another unique press is at work in France.

But what about locomotives, diesels and drilling rigs?

Well, there's something to be proud of and there's something to be ashamed of.

Let us suggest the possibility that the existence of this difference is to a certain extent due to the new equipment plan's "philosophy." Both the Voroshilovgrad association (in particular) and the ministry (on the whole) are fulfilling this plan. On the other hand, these kinds of plans continue the "philosophy", or to put it simply, the relationship between new technology and those who are responsible for it. After all this analysis it seems reasonable to ask whether we are most in need of a new technology plan or new technology itself?

INCENTIVES, MIDDLE MANAGEMENT TRAINING

[19 Dec 86, p 2]

[Text] RECOMMENDED FOR THE JOB

Personnel questions are usually resolved twice each month at meetings of the ministry's collegium.

Careful preparations are made in an attempt to gather all "pros" as well as any "cons." There is a file of materials on each candidate: basic information, the results of interviews, references, approvals from leading central boards and from two deputy ministers, one for personnel matters and the other for branch affairs.

In other words, there are a lot of documents. But the excess documentary "insurance" is understandable: choosing an association general director, an institute manager or a central board chief is an extremely important area in which the consequences of errors can be great. What is striking about the work

of the ministry's personnel services is its adherence to the system and to innovation. They are even thinking of entering into a computer all the information to be considered, from the number of specialists and their "quality" to their capacity for promotion.

In the personnel office we were shown a sheet with an unusual graph. As an element of the "system", it is an evaluation of the working capacity and organizational capabilities of an Elektrostal'yashmash deputy shop chief. Does this "electrocardiogram" make any sense? It does in principle. The peaks indicate high evaluations by experts of his broad outlook, ability to listen to others and personal discipline. The valleys indicate a lack of knowledge about labor organization, an inadequate ability to grasp unfamiliar situations, low demands on subordinates and a negative reaction to criticism and self-criticism. The experts' conclusion: this specialist can be promoted but only on the condition that his shortcomings are corrected.

Here's another situation. A director, the general director, was terminated from the association. Why? No particular faults were given as reasons. Unless he failed to react in a timely manner to instructions from above, put up with shortcomings, or set up a system in which questions were not so much solved as put forward. Those we talked to at the ministry feel that on principle the questions he asked were right and concerned restructuring, the distribution of new equipment and many other issues. So what brought him to this end? It seems that he was not thorough in following up on these questions and did not pursue them to the highest offices. Frankly speaking, is this is a relic of the old style of management in which the squeaky wheel got the grease?

It's hard to disagree with Anatoliy Ivanovich Lazarev, the deputy minister for personnel matters in the branch, when he calls the process of selecting managers a "delicate subject", especially in these times of restructuring. Certainly it's a complex matter which should be based partly on science and partly on intuition, or if you will, a feeling for personality.

How can this feeling be found? This is the question of questions, and one that occupies a great deal of the ministry's time. How can we find a future director, chief engineer, shop foreman or chief economist? How can personnel reserves be identified, and then, most importantly, tapped?

Here's how. The method is well-known in films where doubles were first used. Last year a double's game took place at Yuzndizelmash, Voronezh's Rudgelmash and in Kremenchug. Managers were temporarily reassigned away from their enterprises. They were replaced by candidates for posts that were not yet vacant. The problem, incidentally, comes from the word "yet." It's all right if the "double," having proven his worthiness after the experiment, finds a new job. But it is even better if that situation is the norm. For now however, as the ministry's management personnel section tells us, there are often untouched promotion reserves. The primary enterprise managers are the first to be changed, while promotions are less frequent in the middle level. It seems it is easier to give a candidate a positive evaluation for a promotion than to get him approved for a new post. As a result, young people hoping to become specialists sit in reserve and eventually "burn out."

CONVERTING THE BUREAUCRACY

There are 1,300 persons working at Mintyazhmash today. It's hard to say whether this is too large or too small a number. First, the number has been building for years and second it is less than the statutory allotment.

The ministry's bureaucracy was reduced by 130 persons recently. As personnel experts noted this reduction was primarily in less qualified personnel and in retirees. This is a troublesome matter of whom to order out to a deserved rest, who to help into the ministry's walls and what to do with living people, not "manpower units."

Where does the ministry get people for its bureaucracy? It must be admitted, we think, that they come from the factories and associations. Ministry personnel are not specially trained for their work. That's why it's so surprising that two-thirds of branch headquarters workers have never worked in the branch's enterprises. Why? Ministry personnel workers know the answer better than anyone else.

Here the first problem is how to move people from outlying areas to the capital.

"This is very hard," says Lazarev. "Each candidate requires a decision from the Bureau for Machine Building and Moscow-2. Of course, if an upper echelon position, such as a deputy minister, a central board chief or his deputy, is involved everything comes our way. The complications arise when we want to bring in a middle-level worker such as a department chief or leading specialist.

It seems the branch headquarters' possibilities are limited in these matters. How about looking for people in capital area enterprises? That's fine for the ministry's neighbor on Sakhalin Prospekt, the Ministry of the Electrical Equipment Industry, but Mintyazhmash only has one enterprise in the area. It is far from a giant and is not even a fundamental one at that. So they have to look outside. But are the best people always found outside?

The question is far from popular right now when a decisive reduction of the influx of excess population is underway in Moscow. To us, however, this seems to be a different type of phenomenon. Finding in a huge number of outsiders to staff common professions is one thing, but inviting specialists from outlying areas to participate in the management of an entire branch of the national economy is another matter entirely.

Personnel matters go far beyond this single question. They even affect the structure of the bureaucracy. To be sure, the "limits" here are significantly below previous levels, but we must agree that the relationship between personnel managers and other specialists has become more rigid. The upper level (managers of central boards, administrations, independent subunits and departments, as well as their deputies) should make up 20 percent of the total while lower-level personnel make up the remaining 80 percent. Now there are shortages of managers. For example, the ministry considers it necessary to raise a category of chief specialists in some area but this cannot be done

because the Ministry of Finance still not permit it. In straightforward language: it appears very strange that a branch headquarters has such limits placed on its establishment of bureaucratic structures today.

Here is a characteristic feature: the average age of Ministry workers is over 40. This is a mature age but one can still be daring. However, not much daring is being noted. Does this mean that there is a problem of aging in the bureaucracy? Without a doubt. The problem seems to differ in different types of workers.

During some months this year in the branch headquarters, 30 persons received raises, 30 persons were promoted and 40 persons were moved into management positions. As we can see this movement involved 50% of the bureaucracy. This is how it appears, but the problem becomes clear if you consider that the movement primarily involved managers such as deputy chiefs of administrations and department heads. All was quiet at the executive level. In fact you could say there is stagnation: people stay in the same jobs for decades. It is almost impossible to get around the absence of any hope for stimulating breakthroughs on the job. This has been the work environment of most ministry employees.

Sergey Aleksandrovich Afanasyev has headed Ministry for many years. He is an experienced manager, was schooled in the defense industry, is a two-time winner of the Hero of Socialist Labor Award and is a Lenin Peace Laureate. This says a lot about him. While at Number 14 Gorky Prospekt we heard various opinions on the minister's style and attended a meeting which he led with an iron hand.

Here is the scene at the collegium meeting. Lyudmila Vsevolodovna Gorstikova, a worker at the Mashinostroi Machine Factory, is at the podium. With bitterness she says that the polychrome is being rebuilt halfheartedly and that housing is being built slowly.

"If the only were to take responsibility for these deficiencies," interjected the minister, "we would provide all the money down to the last kopeck!"

"Thank you..."

"No, wait!" S. Afanasyev stood up. "You still need to make sure that the contractor signs everything. Then you have to raise a team and set up a method of operations."

These dialogs also occurred during other presentations. The minister would approach the speaker and pose questions. Often it was clear that he knew more than the speaker did about one or another specific situation.

"How is construction progressing on the school? He gave you a computer as part of its equipment."

"It's set up."

The minister quickly replied, "It's not even unpacked! You didn't go out to the school. You need to go out there and check everything for yourself."

"You see, they criticize us for a low utilization coefficient," he continues, turning to the hall at large. "What's going on? They say there aren't any machine tool operators. But they aren't going to come to you off a street in Gorky. At Voronezh's Rudgomanst they are occupied with questions of socialism and there are no problems with personnel."

His reply to an institute director: "Instead of getting down to technological matters the institutes are writing treatises. Organize your technical assistance better. Get out there and offer and give."

Timeliness, detail and control are all essential qualities for branch leadership. But, they should not be overestimated, particularly now that a course has been set toward strengthening the economic means of control rather than administratively distributed tools and that the principles of management independence are being increasingly introduced into practice. Is detailed monitoring of enterprise activity, often descending to trivial levels, justified under these conditions? Is this an advantage or a disadvantage today? Well, if the man makes the style then the minister's style defines the operation of his bureaucracy. In the case of ministry workers, the understandable desire of a leader to go on to the larger set of concerns which make up the life of the branch is often converted into dealing with a surplus of everyday details.

OVERSIGHT: TRUSTED

Let's look at the ministry's institute of curators, whose job consists of tirelessly monitoring the affairs of "its" enterprises.

We weren't able to catch any curators directly "sitting" in the systems, components and machines they are responsible for, but we did see them sitting in their offices.

Imagine a streetcar in which writing desks had been placed in front of each passenger seat. This is how from three to seven curators and their departmental colleagues are packed in side by side rows. Like the controller of a figure eight, the department chief faces everyone. This is apparently not so much for convenience in passing out instructions as it is for identifying the manager's position. Now, if you consider that most of the work here takes place on the telephone, you can imagine the conditions under which this kind of management takes place.

At the performance level the ministry curator is a key figure. Ideally, the curator should be the ministry official with the most detailed information about conditions in his factory. Primarily this is because the curator is in almost daily contact with the factory manager. Second, the curator spends up to 15 days a month at the factory itself.

"Right now I'm talking to you," says A. Kostin, curator of the Leningrad association, "but by the end of the day I could be back in Leningrad."

Why are these trips necessary? To study the situation on the spot? Sure, the situation is not hard to visualize from Moscow, production is known backwards and forwards (the monitoring goes on for years and decades), there is continual telephone contact and monitoring. Aleksandr Nikolayevich [Koskin] shows us a thick file of hundreds of product listings. All this is constantly updated and documented. But nuances, details and peculiarities can be picked up on the scene. Once these are discovered what happens? The curator persuades, motivates and threatens, if necessary. He helps to achieve agreements between shops and factories, prepares suggestions for what to put into production at what facility and what to shift to which enterprise.

All in all the curator's institute is a fast-acting but administrative force. It is a necessary and in some cases essential factor. But we must consider that the curator function is primarily in existence because the imperfect scheme of management tools and production relationships is not working. There is a product line plan, there is an internal cooperation agreement and there is the plan itself. Why does something else have to be added to produce an effect?

We are told that the curator analyzes the production situation and develops recommendations. Just how deep is this analysis and how effective are the recommendations? M. Golikov is an experienced engineer who before the reorganization was a manager at one of the restructured all-union production associations. He now heads the Southern Ural Machine Building Factory Production Association. The association failed to meet its plan goals in the very first year. It was behind with the previous curator and it is behind with the new curator.

We couldn't determine how to define the curator's main job. Either he represents the factory's interests at branch headquarters or he is the ministry's representative to the factory. He's one or the other they say. This is the core of the problem. Everything revolves around his function. We cannot exclude the possibility of the curator's institute existing under the new management conditions, but in such a case its content and duties would have to change radically. It would be a matter not of following up on details at "its" factory, but of helping the factory to solve strategic questions. This is a goal that would be in harmony with the prevailing conditions of cost accounting autonomy.

But you have to prepare differently for a different job.

The National Management Academy was established eight years ago with limited powers. At any rate, the personnel potential it can train for any specific branch, including heavy machine building, is a drop in the bucket. Furthermore, the academy trains "captains" of industry--deputy ministers and central board chiefs.

Where are middle-level managers and ordinary ministry workers trained? Practically nowhere. Until now, the personnel training system did not go in to specific detail concerning management work. The traditional conviction that the career path is from worker to minister hasn't been confirmed in practice.

Leading specialists, senior engineers and ministry department chiefs often come to their posts by chance and without special training. They simply change their specialization and learn on the job.

Meanwhile the new tasks require new approaches, new concepts and a qualitatively new type of training. For instance, Mintyazhmash plans a program of introducing computers and electronics in production. This is not a passing fad--it is an actual requirement. Where are the personnel, people who know the principles of management in addition to computers? The ministries are involved in acquiring these very people and they are selecting staff from all branches! Have they undergone specialized training, are they trained and are they prepared?

This is an interbranch problem and we cannot delay its solution if we are convinced that personnel form the critical link in the restructuring process.

PERSONNEL ATTITUDES, PROBLEMS, QUALITY CONTROL

[20 Dec 86, p 2]

[Text] SATURDAY, OCTOBER 32nd

It was Saturday, October 32nd at Mintyazhmash. The calendar was somewhat strange (on the street outside at the same time it was the normal November 1st) because the weekend coincided with the end of the month. Friday was the October 31st so it was counted as part of October. Monday is the 3rd of November. As we have noted the ministry's plan this year is occasioning blood and sweat. Well there is sweat but the plan still isn't working out. So an uncounted Saturday is used to pull up lagging sections. As they say, heaven knows.

We agreed to meet with Main Production Administration workers on Saturday, October 32nd according to the ministry's calendar. However, reaching the agreement wasn't all that simple. On the night before the meeting the central board chief's secretary refused to put us through to her boss, Ye. Marmontov.

"Today is the 31st," she warned us, "Yevgeniy Aleksandrovich [Marmontov] doesn't have any free time. Tomorrow? All the more so. Tomorrow is all work."

So we entered into the Main Production Administration while it was fully at work. This is the ministry's executive committee where a law (plan) is obtained from legislators (planners) and its implementation is organized.

The situation in the ministry building on that day appeared typical. Even the escalators which brought people from the first floor to the third floor elevators were working. But what's this? Nothing was being accomplished at the doors, escalators, entrances and exits, the flow of people was missing.

With the courtesy of someone on duty we asked those we managed to meet, "What are you doing working on Saturday." They answered with the animation of someone on duty: "What else, we're always on the job on Saturday."

It's a familiar sight, the working Saturday has stopped being a novelty in many management organizations. This temporary addition to the five-day week became fashionable and like any other temporary structure has become essential and, judging by its prevalence, will continue for some time. Of course, it can hardly be termed an advance in the organization of management operations.

On the Saturday we observed not everyone came to work, but many did and those who came worked! This was felt in the empty halls which are more crowded on workdays, in the absence of people in the smoking areas and in the lack of a wait for an elevators. Now one could literally take the first one that arrived. What do these observations mean? Obviously, those who had to come to work on Saturday were freed not so much by the end of the workday as by the end of the work itself. Something else is also observed here: it is hard to put forth a maximum effort from Monday to Friday knowing that Saturday is an actual workday.

Of course, this is only a cursory observation. It is possible that a survey we planned to conduct in the ministry offices, just as in the Vorshilovgrad Locomotive Building Association collective, would have provided the basis for a broader conclusion. But, unfortunately, Mintyazhmash management categorically opposed the circulation of anonymous questionnaires among its workers. The opposition is interesting, which did they fear most, the proposed questions or the possible answers?

SOURCES OF GUARDIANSHIP

At the Production Administration we asked the following question: How do you carry out your main function of contributing to the fulfillment of plans?

"Here's how," Yevgeniy Aleksandrovich Marmontov had promised to be as frank as possible (and he was true to his promise), "we pick up the phone, dial '8' then the city code and the telephone number and the factory manager is on the line." After that everything is routine: questions, answers, explanations and clarifications. There are other tools, but this is the main one and it's a broad-ranging one." Yevgeniy Aleksandrovich nodded toward his telephones (there are eight or nine on his desk).

We talked with Yevgeniy Aleksandrovich about economic management methods, the possibilities of cost accounting and self-financing. People were always coming in and out, some wanted quick answers, some agreed to come back later and some joined our argument. And believe us not a single court would have taken up our argument because there was full agreement among the sides. Everyone was not just "in favor", they proposed ideas, brought up examples and cited authorities. It's needed, it's high time and there is no other viable type of management other than economic management.

The telephone was the only thing that disturbed our harmonious meeting. The secretary had found and connected the next director, probably from a list of

those who are behind, and Yevgeniy Aleksandrovich, excusing himself from the conversation (or maybe for the fact that he was having to depart from its spirit?) roared into the receiver:

"What's going on? You've got to fulfill your assignment."

Another telephone rings. A new director is on the line.

"You have to do it. Understand? You must," Marmontov warns someone. "Report to me tomorrow. Of course I'll be at work."

The feeling is obvious, tomorrow, Sunday, will be October 33rd. Two young administration workers participating in the discussion looked at each other sadly. Here we have to think: is it possible that daily management practice is so monotonously and ruthlessly placed before all managers with no distinction being made between those who are behind and those who are progressive? Is it possible that, in the final analysis, all are being forced to act identically, regardless of their economic views?

What substantive economic achievement can be undertaken by the head of a ministry central board (not just a production administration)? Pass on the order to another with more authority for implementation? "Lop off" the enterprise's means of raising assets? Or, on the other hand, grant the right to factories themselves to change the prices of their products according to their management circumstances and to seek out the required suppliers and even creditworthy clients? Absurd! No central board chief would allow any such thing to happen. Everything has been decided in advance outside the ministry by such agencies as Gosplan, Gossnab, the Ministry of Finance and the USSR State Committee for Prices.

Any up and coming worker understands, or will soon come to understand, that each new rung on the administrative ladder only expands his administrative capabilities. These capabilities then require implementation. The instrument determines the performance: a piece written for the piano cannot be performed on the violin, even if the artist owns both instruments.

"Do you think I don't want to get away from trivial matters?," said Evgeniy Aleksandrovich as he placed a chart on the table. "Here's some outstanding material for you to use to criticize me for nitpicking. Everyday I am responsible not for factories and not for types of products, but for individual items. And what kinds of items are these? Those we are having problems with. Here's an example, journal boxes. A nonsensical item, trivial in the scheme of the ministry as a whole. But nine railroad car factories are being held up by a shortage of journal boxes. Once this is straightened out something else will come along. I don't know, it could be wheel pairs or some kind of clips. You never know in advance what the problem will be. Either we're at fault, or the supplier is at fault--it really doesn't matter in any event. The fundamental thing is that losses are almost impossible to make up in series production and our job is to keep these losses at a minimum. You can complain about trivial matters for as long as you wish, but the fact is that as long as these so-called trivial items threaten the fulfillment of the ministry's plan, I, my deputies, chief engineers, senior engineers and even

junior engineers will sit on these components and units and control their production. There is no way around it. I must have a maximum of information about key items, otherwise there is no way to control the situation."

However unconvincing these words sound, they do bring one thing to mind: the outlook of ministry workers on enterprise trivia will not change. Therefore, the real task at hand is to change not only the management system but also the manager's conceptions.

ONE DAY ON THE AGREEMENT

Everyone at the ministry has his concerns. For instance, why does R. Kordize, chief of the Finance Administration, know the names of nearly every shift supervisor at the regional telegraph offices and of nearly all the operators in the intercity telephone network? Because a lot depends on these people, namely the ministry's financial well-being. They are the last link in a short but tortuous chain of cash flow from customers. No, the individual communications workers don't owe anything to Mintyazhmash, but agreements to pay for products received often are extended almost to the last hour of the last day of the accounting period. Therefore, a lot (if not all) depends on the speed at which telegrams of payment are sent and received.

Of course, many Mintyazhmash customers pay on time for equipment received, but there are more than a few customers who delay for months even while the machines are in operation. These customers require a massive effort on the part of a large number of ministry workers.

This work begins at the factories themselves. Telegrams are sent as reminders. Then personnel are sent to the client enterprises. But what can be done if the customer simply is not credit-worthy. Then telegrams are sent at the ministerial administration level. Usually even these measures do not achieve results. Then members of the collegium, sometimes even the minister, join in the struggle. This usually occurs at the last minute.

"This entire humiliating procedure," says Robert Levanovich Koridze, "turns the last days of any month into true torture and a headache. Believe me, we can't keep up with the work! We don't have any effective economic or administrative means of dealing with those who do not pay. Penalties do not solve the problem. I believe that if the mutual accounting system is not improved the idea of self-financing could be compromised."

Entering into the conversation, Yevgeniy Aleksandrovich Marmontov stated, "Add to that the fact that we produce a large amount of expensive and often unique equipment. It's designed for a specific purpose at a known address, either an open-pit coal mine or a metallurgical facility. Unlike car manufacturers, we can't just shift over to other more creditworthy customers. We are tied to all our customers! The result? Stricter regulation of management relationships. So, the situation is that for 29 days they say to us, 'Produce, ship!', and on one day we say to them, 'Pay, for heaven's sake!'"

This is illogical. How much can the volume of unnecessary management activities (together with unnecessary personnel, of course) be reduced if the

system of management relations between the enterprises and the branches would develop as outlined in the improvement principles adopted by the party congress? How could the ministry of the future be any different? It would be filled with control and no attention to detail instead of attention to detail without control.

It seems the further you go from Moscow the more abstract the ministerial bureaucracy and its workers becomes. This is not because the ministry is an abstract concept to the factory managers. On the contrary, all factory levels have frequent guests. The "comrades from Moscow" as a rule arrive to verify the status of this or another matter, to make inquiries and to prepare a question for the collegium. The specific nature of these types of visits creates a certain neutral image of the inspector. Even the word "inspector" long ago degenerated from an adjective to a substantive.

But when explaining something to a threatening inspector, who can think that the person spends his dinner break in long lines at the ministry cafeteria, which by no means provides a striking impression? Who could guess that the central board's representative can work off "his" time at a vegetable garden or on a kolkhoz? Who can imagine that a man "in charge" of an entire group of plants with thousands of workers tries to type out his next report with one finger on a typewriter (typists and secretaries are the first and often the only ones to go in a reduction)? Who knows that the representatives of the supreme branch authority wait their turn to talk to the enterprises by telephone because there are fewer telephones than workers in their offices?

A quarter of a century ago in his work "Pismakh iz glavka" [Letters from the Central Board] Anatoliy Arganovskiy pinpointed the nature of white collar work as "invisible work." Regardless of how broad this definition, the author called for fully respecting the work of those who each morning sit at desks and prepare documents, make telephone calls, read, consider and think.

Has the work of managers become more visible in the 25 years since? Let's be frank: neither their basic activities, their primary tools (paper, pen and telephone) nor their prestige have undergone any visible change. The call put forth long ago is again updated. Let us add further: the restructuring which is beginning now doubles and triples its urgency.

How can this type of respect be implemented? What can be done to make bureaucratic work more visible and attractive? First, anyone working in a branch headquarters must have the right to resolve questions instead of merely being responsible for them. Management representatives also need independence just as the enterprises they control. Second, there must be maximum effort made to reduce catch up work and to provide managers with the technical and legal means of developing a branch growth strategy. Third, headquarters personnel should be equipped with something more than ball-point pens: computers, terminals and similar modern trappings of management work.

Finally, we do not want the readers of this series to develop the impression that we are saying bureaucrats are sitting in their offices and shuffling papers. Of course, we met people at random and some of them did not want to see any type of change. But most of those working here know and love their

work. Their knowledge and energy can and must be used with greater success to benefit us all.

EDITORIAL NOTE: At this the end of the "Letters from the Ministry" series we would like to emphasize first of all the special role and responsibility of the USSR Ministry of Heavy and Transport Machine Building, as the leading core branch of machine building, in increasing the technological level of our nation's industry. The branch was a pioneer in the new management conditions and from this we could initially expect an indication of the depth of restructuring to be expected. However, as the analysis shows, this ministry's restructuring has been half-hearted and therefore did not lead to any notable final results. Moreover, there was a decrease in the branch's work. Mintyazhmash's former style contained techniques of management by directive which run counter to the course of strengthening economic management tools. The branch's headquarters still has not made the necessary practical conclusions from the serious criticism directed at it recently. These conclusions must be drawn.

Conventional discussions in collegium meetings will not suffice here. Decisive action, and fundamental changes in management style are required. The problems contained in the article are not exclusively those of heavy and transport machine building. Many branch ministries are mired in day-to-day activities and strategic questions go unresolved due to expressive preoccupation with trivial details at the enterprise level. Restructuring will not take place of its own volition at any ministry. There must be a struggle for restructuring. When speaking of our economic headquarters, the strategy for this struggle was strictly defined by the 27th CPSU Congress which directly stated: "At last it is time to end the practice of excessively detailed supervision of the enterprises by ministries and departments. The ministries must concentrate their activities on questions of technology policy, branch-internal distribution, and satisfaction of the national economy's demand for high-quality product's from their respective branches." These are the criteria that should be used today to evaluate the activities of all ministry workers, from the economist to the minister.

We cannot fail to note an important event. The ministries have to act under conditions in which the leading management organizations, primarily Gosplan, and the USSR Ministry of Finance, have declared the need for restructuring. In practice we often see stereotypical methods at work which counter the new management conditions and which, in spite of the demands of the time, do not release entities from the need to solve current questions which limit the branch ministries from shifting to new management methods. In other words, the restructuring must fully involve the departments which define its strategy, tools and incentives, so that there will be centralized control only over those items which determine proportions in the national economy as a whole. Meanwhile, the day-to-day activities of the management elements will be conducted independently.

This is the reason for the discussion of restructuring which began by describing the work of the Voroshilovgrad association and Mintyazhmash. We intend to continue this discussion by analyzing the activities of our central planning, supply and finance entities.

LENINGRAD'S MACHINE RETOOLING PLAN OUTLINED

Moscow EKONOMICHESKAYA GAZETA in Russian No 47, Nov 86 p 2, 4

[Tass report on speech by L.N. Zaykov, Politburo member and CPSU Central Committee secretary, and speeches by participating members at recently held conference (date not given) of city and oblast economic managers at Elektrosila Production Association imeni S.M. Kirov: "Fundamental Tasks of Machine Builders"; first two paragraphs are source introduction]

[Text] The machine-building complex is the foundation of technical progress. Its key role in modernization of the national economy was again emphasized by the June (1986) Plenum of the party's Central Committee.

In order to solve the tasks set by the 27th CPSU Congress, it will be necessary to modernize in a short time Soviet machine building, restructuring it for the production of systems and complexes of equipment of the highest technical and economic level for all sectors of the national economy. An important role in this process has been assigned to the machine builders of Leningrad, one of the country's leading industrial centers.

Recently, a conference of party and economic managers of the city's and oblast's machine-building enterprises was held here at Elektrosila Production Association imeni S.M. Kirov. Member of the CPSU Central Committee Politburo, Secretary of the CPSU Central Committee L.N. Zaykov took part in it. In his speech he said:

The dynamics of the process going on in the country's life is especially convincing in the work of Leningrad's machine-building enterprises, a number of which I visited. All of them hold fresh in their memory the words of General Secretary of the CPSU Central Committee M.S. Gorbachev enunciated here on Leningrad Soil in May of last year to the effect that the "Leningrad party organization, the working class of Leningrad and all workers of the city and oblast are an advanced detachment of the Soviet people, a reliable support of the Leninist Central Committee at all major turns of history in the past and in the accomplishment of the historic tasks of the present, which is also a difficult stage in the development of our society."

Today, when the road of initiative, independence and creativity is so broadly open, it is, of course, more difficult to work, but it is much more interesting and fascinating. I think that these words are not exaggerated.

We all are witnesses of how since the April 1985 Plenum of the CPSU Central Committee and the 27th Party Congress our life is consistently being renewed and the best traditions of our people are being revitalized.

The selfless labor of the Soviet people in carrying out the policy of acceleration of the country's social and economic development provides positive results in all sectors of the national economy. Targets are being fulfilled for most economic indicators.

It is of fundamental importance that the long-range strategic growth factors--acceleration of scientific and technical progress, intensification and improvement of the production structure, restructuring of the investment process, improvement of product quality and resource conservation--have begun to be more fully operative.

At this meeting I would like to have an exchange of opinions on ways of solving the tasks proposed by the party for machine building at the present stage. M.S. Gorbachev stresses that a sharp qualitative change in machine factor in building is a key CPSU internal economic policy and the transition of all sectors of the national economy to intensification.

Actually, the time has placed machine building in the vanguard not only of economic and technical restructuring but also of our thinking. If the main field of battle for implementation of a new politician course of acceleration and for restructuring is the economy, then figuratively speaking the weapon with the aid of which this could be achieved would be made by machine builders. This position was formulated clearly and unequivocally by the party.

Boosting the effectiveness of the economy, accomplishment of planned structural improvements, solution of social problems, strengthening of the country's defense capability and its international prestige, growth of the magnetic forces of our economic example and development of trade with foreign countries--all these very important problems are tied into one tight knot by the results of restructuring machine building. Without a powerful qualitative spurt in machine building it would be impossible to assure the fulfillment of designated plans. Thus we are dealing with questions of both economic and political significance.

The party's Central Committee deeply understood all these stages of economic construction, its rises and falls and extracting lessons from the past and has come to an essentially scientifically valid conclusion on the accelerating development of machine building and on this basis proclaimed the current five-year plan as the five-year plan of machine building.

The CPSU Central Committee and the Soviet Government have made cardinal additional decisions on speeding up the development of the complex of machine-building sectors. Their exceptional importance and fundamental nature are attested by the fact that the CPSU Central Committee Politburo found it necessary to submit these decisions, as you know, for the consideration of the June Plenum where they received full support.

Everything has been provided the machine-building complex that our economy has at its disposal. For a year or two, the construction and development of a number of enterprises of other sectors were halted. Management of the complex was restructured before all the others and large capital investment was allotted. In a word, the maximum of everything was provided.

The tasks set are out of the ordinary. And the ways of their accomplishment and approaches to them have to be unusual. Machine building in terms of the growth rate of production must outstrip the country's industry as a whole by more than 1.7-fold (for machine building, the growth rate is 43.2 percent; for industry it is 25 percent). It would not be out of place for purposes of comparison to remember that during the past five-year plan industry as a whole grew 19.9 percent and machine building grew 25.3 percent.

In the considered years—altogether 6-7 of them—machine builders have to reach the top world standard in regard to the parameters of their principal products. The task is revolutionary with nothing comparable in practice. Here everything is new—scale, depth, strict specificity of designated advances and time periods. This work will require full mobilization of resources and complete self-reimbursement [samootdacha]. There simply is no other possibility, no other way.

Assessing the results of the past period of the first year of the five-year plan, D.N. Zaykov then said that it is possible to point out with satisfaction that the course of advancing the development of machine building is being maintained on the whole. Equipment output growth is occurring basically because of the equipment, machines and instruments which determine acceleration of scientific and technical progress. Thus production of flexible modules has grown 2.7-fold; of industrial robots, 1.9-fold; machine tools of the processing-center type, 1.5 fold; metal-cutting lathes, forging and pressing equipment with digital programmed control and rotor and rotor conveyor lines, 1.3-fold; control computer complexes and power equipment for atomic electric power stations, 1.2-fold.

On the positive side, new methods of management are manifesting themselves. Consideration of questions of economic effectiveness of economic activity has become more noticeable. The creative activity of labor collectives has grown significantly. The managers of those sectors, associations and enterprises are acting correctly who adopt the most progressive elements of the economic mechanism.

Thus machine builders have taken the first steps in the direction indicated by the 27th Party Congress. At the same time, one cannot help but be concerned that the possibilities which domestic machine building possesses have so far not been used fully. Serious lapses are being permitted in observance of plan discipline, fulfillment of contractual commitments, raising of the technical level and quality of manufactured products and economy of material and technical resources.

In other words, the restructuring spirit unfortunately has still not become the core of daily practical activity at all the management levels of enterprises and associations. Not only inertia in thinking but also slowness

in adoption of decisions and sluggishness in their implementation are still strong.

The CPSU Central Committee offers such and only such an evaluation of those negative happenings which still persist in these or those sectors of economic and cultural construction. This means, L.N. Zaykov then said, that all the main work is still ahead. Here are the first-priority problems to which I would like to draw attention:

First. Praising the technical level, quality and competitiveness of produced machines, equipment and instruments—everything has to start from here. This is the point of departure of all work. Why should such a question even be raised? In approaching 1987, machine building will have to produce no less than 38 percent of the most important types of products meeting the world standard. The advance in itself is big, but by the end of the five-year plan, new generations of equipment will have to amount to 80 to 95 percent of machine-building production.

It must not be forgotten that our personnel have been accustomed to an average standard for much too long, guided by lowered criteria and frequently offering them as the highest. A philosophy of imitation was confessed.

Of course, those specialists who were accustomed solely to copying foreign equipment, and feeding themselves with known ideas, were unable to solve set tasks without restructuring even with the aid of the most modern computer aided design systems. A radical restructuring is needed of the whole system of scientific-research and experimental-design work. Moreover, this needs to be done while in operation. Defects in plans today are defects that lie 15-20 years ahead. They are the ills of future production, inadequate productivity and low equipment efficiency.

The main thing now is to approach the role of the designer, technologist, engineer and all creators of progressive equipment and technologies in a new way. In the last 2 years, the CPSU Central Committee and the Soviet government have done everything possible to remove organizational and economic barriers which interfered with the creative approach to the matter. Wage conditions have been rapidly changed, limitations in earnings of specialists were removed, freedom was granted in the selection of forms of organization of their work and the creation of creative collectives.

But these decisions, which we have for so long striven for, are being carried out in a halfhearted fashion at a number of Leningrad machine-building enterprises. Who but you, comrades, the initiators of a new approach to payment of engineering and technical labor, should provide an example of elimination of all causes of slippage of the new methods of organization and pay of specialists? One should proceed from the fact that an active position of the developer and scientist aimed at tomorrow's standard of equipment must become a rule everywhere rather than a rare exception as has been the case until recently. Unlimited possibilities need to be opened up for capable and enterprising people.

Much has been overlooked in the training, selection and placement of personnel. Economic managers together with party committees will have to do a lot of serious work in this direction. Labor collectives, be they a shop, wing, plant department, bureau or laboratory, must not be permitted to be headed by incompetent people who have lost the feeling of the new. The process, of course, is not a simple one. If we were to say that the main thing in restructuring is activation of the human factor, we would have to be consistent.

In order to speed up the creation and utilization of new equipment and to increase the tempo of scientific and technical progress as a whole, special concern would have to be given to strengthening experimental bases as well as shops and services for preparing the production of new equipment, which at every plant, I repeat at every plant, would have to amount to no less than 7-10 percent of its productive capacity. Everyone speaks of these fundamental questions. They speak sharply because the development of these services is manifestly lagging.

Second. The party congress set a task for each association and enterprise as well as for the sector as a whole to work out long-range plans going beyond the framework of the current five-year plan of renewal of production on the basis of modern equipment and technology. Actually, the concern is for each labor collective to have a clear picture of future reequipping of production equipment and technology, improvement of production relationships, transformation of the social sphere, and improvement of working conditions. Major social and political work must be developed around this program. High aims, understood by everyone, must raise the masses and inspire them to conscientious work. Leningraders in this connection have accumulated much experience through implementation of the Intensification-90 Program. Now it must be concretized in the spirit of the time while taking into account the new tasks and looking further into the future.

Local checks have shown that the program tasks set before machine builders for the 12th Five-Year Plan have not been developed at many enterprises, associations, scientific-research institutes and design bureaus into clear-cut plans of action and have not been reinforced with a complex of measures ensuring the fulfillment of the targets of the five-year plan, not to speak of the long term. Such gaps also exist at a number of Leningrad machine-building enterprises, including even in the practice of implementation of previously worked out programs of Intensification-90. An assessment has been made by the party's Central Committee of the operation of ministries in this regard. There is a need to rectify the situation more quickly and to double and triple good organization.

Third. Together with the processes of production renewal and restructuring of the organizational life of collectives, we directly link more effective use of the existing potential. In visiting the localities one can see what is going on, how even at the best enterprises machine tools that are 20 or even 30 years old stand beside modern machining centers. At the same time, progressive varieties of equipment are used in many cases in one and sometimes not even a full work shift.

The party has determined an approach to the solution of this pressing problem. In May of the current year the CPSU Central Committee Politburo approved the initiative of the Leningrad Oblast Party Organization of going over to a 2-3 month work regime. Many economic managers of Leningrad machine-building enterprises have made a good work start. Their example has been actively followed by the workers of Kharkov, Ilyumovsk and Belorussia.

But cases are known attesting to the fact that certain managers, and there are such in Leningrad, are still trying to get started; they try out, thinking what machine tools should be moved where. Nobody can afford to lose any time. I say this because everyone is obliged to give a full accounting that the problem of organizing the transition to the new work regime can be effectively solved only in a regional context together with ministries. Economic managers with the participation of party and soviet organs locally should assume organization of the work.

Fourth. In the solution of the chief task of improving the existing production potential, we should undeviatingly hold to the course of the investment policy primarily for reequipment and modernization of existing enterprises. It should be said that from the point of view of actual investment, the work does not look bad at present. It is improving, and its relative share in most cases is approaching 50 percent. This is a correct approach.

What could hold back putting this important policy into practice? Resources of progressive equipment—here is where a bottleneck could be formed. A big mistake was made by those who only hoped for centralized development of machine-tool building in the country and pushed aside the solution of the problem that had become urgent over the years of developing one's own machine-tool building. In this regard each economic manager must quickly reorganize and energetically increase the capacities of the production base for the manufacture of technological equipment and other equipment with one's own resources.

Another route is also important. We should determinedly engage in a radical modernization of machine tools that are being dismantled because of the transition to the 2-3 month work regime. It would be possible to manufacture model components and units on the basis of mutual cooperation. I am confident that Leningraders cannot be beat in such work. Think seriously about this.

The future reconstruction and modernization of enterprises is indissolubly linked to the work of construction organizations. They today, as we know, are decisively being reorganized. In construction, a radical reform is being carried out. The party counts on the success of the work. At the same time, it is necessary even under these conditions to develop without fail construction with plants' own resources. Especially since providing them with material resources at this time has been assigned to the level of capital construction. Not everyone has realized so far the importance of this way of building up potential, but it is necessary to change without fail the psychology here.

The tasks of speeding up development of machine building need to be resolved in an integrated manner. I have in mind social questions. If a manager forgets about the social sphere, then he can expect failure in production. No latest technologies and processing centers will rescue him. Development of the social sphere must occupy a worthy place in all operational and economic activity.

Fifth. An extremely important task, and at the party congress this was especially emphasized, is putting into practice the principles of genuine cost accounting, self-refinancing and self-financing, introduction of the collective contract not only in brigades but also in large production subdivisions and development of the economic mechanism.

A certain amount of experience has already been accumulated in this. The practice of AvtoVAZ Association and the Svy Machine-Building Association (near M.V. Frunze) is of the greatest value. Beginning next year more than 400 machine-building associations and enterprises will be operating under these conditions. But I have become convinced that there are few such enterprises in Leningrad so far.

Managers of associations and enterprises that are changing over to the new conditions need to take in hand the situation in each production collective, small or large, and themselves master more thoroughly the new economic approaches to the organization of operational activity and to direct to this the entire management apparatus. It is necessary to concretely study developing problems, to respond to them without delay and to increase public knowledge of results from the new conditions of management.

You can well see the work being conducted in the region on improving the organizational management structure, the development of production and scientific-production associations and the creation of intersectoral scientific and technical complexes and engineering centers. Through the means of these structures, the party and the Soviet government aspire to realize the advantages of the socialist system of management. For this reason the question of creating all the conditions for their viability and great effectiveness is not only an economic but also a political question. You can suggest a great deal for its solution. We expect proposals from you.

Sixth. Recently the CPSU Central-Committee Politburo enacted an important decision on developing foreign-economic activity. A number of industries and, I want to especially emphasize, associations and enterprises are being granted the right to directly go into the foreign market. In Leningrad, at the first stage, such a right was granted to Izhorskiy Plant Association, the Leningrad Metal Plant, the Nava Plant, Elektrosila and several others.

I shall say outright that the problem has not been confronted so throughout our entire history. But its solution requires nonstandard approaches, completely new thinking and deep psychological restructuring. It is necessary to learn a great deal here—to produce good, competitive machines and to learn to trade, to build business relationships with foreign partners.

The very first step today in this is to create an atmosphere of creative white heat in each collective of machine builders. The quality and reliability of a machine or machine tool depends 90 percent, if not more, on the immediate performer, on what we call the human factor. We have to proceed from this, organizing work at enterprises in all its aspects.

From Speeches of Conference Participants

General Director of Elektrosila Production Association imeni S.M. Kirov B.I. Fomin:

"First proposal--Let's try an experiment, and for five years, say, stop introducing new standards and make only operational changes, except in special cases.

"The next question: it is necessary for enterprises to get modern automated systems simultaneously with programs and software. This also applies both to automated planning systems and flexible production systems. The creation of programs and software without one's own resources is not a solution to the problem.

"Now on further development of capital construction. The time has come when mutual responsibility of the client and the contractor is required for general capital investment.

"One more thing: even today, in our view, the worthless practice of equipment replacement exists. As soon as an enterprise with its own money installs new equipment, it has to pay for each ruble of installed equipment 2 rubles for growth of capacities. A number of enterprises in this connection are reluctantly undertaking reequipment."

A question from the auditorium:

"How necessary is it?"

B.I. Fomin:

"What is beneficial for production, we install with our own money. What has become obsolete needs to be withdrawn as soon as possible. This procedure should be secured in the law on the socialist enterprise--we handle ourselves what has been earned."

General Director of the Leningrad Neva Plant Association imeni V.I. Lenin G.F. Velikanov:

"It is necessary to improve planning. I believe that it should be pointed out in the law on the socialist enterprise that plan targets, especially in schedules, reach production on time rather than late as is the case now.

"Another thing on planning. We are apparently working for a reduction in the number of all kinds of indicators, but their number is still growing. For us, for example, they are planning 300 of them.

"At the same time, no matter what we say, we are unable to get rid by any manner of means planning in tons. The association acquired a new metallurgical mill for making billets of exceptional precision. But with such planning it simply is of no benefit."

General Director of Elektronmash Scientific-Production Association P.I. Radchenko:

"I consider it necessary to introduce a more flexible policy in the field of creation of programs for machine tools with numerical control. I think that many programs are being proposed unjustifiably. It is necessary to reduce their number but at the same time to improve quality. This is how I see a comprehensive solution to this question."

"Conference participants are making a whole series of proposals and wishes aimed at the fastest possible solution of basic questions of speeding up the development of Soviet machine building. They deal with practically all sides of the work of enterprises and sectors."

"Some of these proposals can be realized effectively, other require careful study. But the main idea that was voiced at the conference is that Leningrad machine builders are not going to wait with folded arms till favorable work conditions are created for them. The country needs improved equipment immediately, now, and the point of restructuring going on in the sectors and at enterprises is to achieve without delay a decisive turn for the better, to use existing reserves more fully for this and to put an end to moods of dependency, complacency and emulation of obsolete models. It is namely toward this that the party organizations of Lenin's city are directing the labor collectives of all sectors of the machine-building complex."

Candidate member of the CPSU Central Committee, First Secretary of Leningrad CPSU Obkom Yu.F. Solovyev participated in the conference.

In a discussion of the questions, Chief of the Machine-Building Department of the CPSU Central Committee A.I. Volskiy, Minister of USSR Heavy and Transport Machine Building S.A. Afanasyev, and responsible personnel of a number of ministries and departments took part.

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MINISTER PANICHEV OUTLINES INDUSTRY'S FIVE-YEAR PLAN

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 11, Nov 86 pp 2-4

[Article by N. A. Panichev, USSR Minister of Machine Tool and Tool Building Industry: "Basic Directions of Machine Tool and Tool Building Industry Development in the 12th Five-Year Plan"]

[Text] The 27th CPSU Congress approved the strategic party policy, worked out by the April (1985) CPSU Central Committee Plenum, of accelerating development of the national economy on the basis of scientific-technical progress.

The June (1986) CPSU Central Committee Plenum and the speech by CPSU Central Committee General Secretary M. S. Gorbachov at it were an important stage en route to implementing the resolutions of the 27th CPSU Congress.

The June (1986) CPSU Central Committee Plenum re-emphasized the special role of machine building in carrying out the plan for renovating the national economy. All the pressing problems of the economy are focused precisely in this branch, the Plenum noted. If machine building is not modernized quickly, if it is not restructured to produce new systems of machinery and progressive equipment for all branches of the national economy, we will not be able to resolve the tasks set by the Congress.

The resolutions of the April (1985) CPSU Central Committee Plenum and the 27th CPSU Congress on developing machine building are reflected in the state plan for the 12th Five-Year Plan.

The 12th Five-Year Plan anticipates a 43-percent increment in machine-building output, which is 1.7 times higher than for industry as a whole. Capital investment is being increased 1.8-fold. As we see, the outstripping factor is quite significant, which will permit strengthening the priority positions of machine building in the national economy.

In line with the indicated rates of development of machine building and the responsibility the Party Central Committee has entrusted our branch with for renewing the assets of the machine-building complex, the state 12th Five-Year Plan outlines high indicators which will ensure the accelerated development of machine tool and tool building industry.

The practical significance of the concept of accelerated development to us is a significant rise in the rates of branch economic growth, with simultaneous substantial structural rebuilding to produce automated equipment and meet world standards with it.

The branch plan for the 12th Five-Year Plan is at the top level anticipated in the "Basic Directions of USSR Economic and Social Development in 1986-1990 and Up To 2000" in a majority of its quantitative and qualitative indicators. Thus, the production volume growth rate is 156.9 percent and the labor productivity growth rate is 154.8 percent. The increment in these very important indicators exceeds the 11th Five-Year Plan 1.6- to 1.7-fold. The average annual rate of production volume growth in the 12th Five-Year Plan will be 9.4 percent, as against the 5.9 percent achieved during the 11th Five-Year Plan. Thus, a foundation has been laid for the outstripping development of machine tool manufacturing relative to machine building as a whole.

The release of equipment for stockpiling blanks will grow at outstripping rates, including a 167.8-percent growth in forge-press equipment and a 172-percent increase in technological equipment for foundry production.

There has been a fundamental re-examination of the output structure. Less manually-controlled equipment is being produced. Thus, the release of manually-controlled multipurpose machine tools is being decreased by 130,000 units over the five-year period. Practically the entire increment in metal-cutting machine tools will be achieved by increasing the release of such progressive groups of equipment as NC machine tools, "machining-center" types of machine tools, flexible manufacturing modules and industrial robots. For branches with large-series and mass production, the release of automatic and semiautomatic lines will increase 1.7-fold.

Given a 1.7-fold overall increase in foundry equipment production, the production of foundry machinery with programmed control and various pieces of automatic equipment will be developed even faster.

The release of highly productive hard-alloy plates with wear-resistant coatings, which do not need resharpener, is to be increased three- to four-fold. The release of tools for NC machine tools and automatic lines is to be increased 2.7-fold.

We face particularly big jobs in reshaping the structure of forge-press production. Developing the production of automated resources-conserving equipment enabling us to solve the problems of both labor productivity and quality and to change our working conditions has been moved to the fore. Thus, the release of NC forge-press machinery is to increase 3.3-fold and the release of mechanized and automated machinery is to increase 1.9-fold. This means that one of every two machines will be automated. The production of automatic powder-extrusion machines, swaging machines, robotized hot- and cold-stamping complexes, and equipment for fundamentally new technological processes such as twist-upsetting blank forging, laser location and spacing of blanks, and so on, will be considerably developed. The release of automatic forging-stamping lines will be increased more than two-fold.

The production of rotor and rotor-conveyor lines will continue to develop. Some 330 such lines will be manufactured over the five-year period.

The output structure for the 12th Five-Year Plan is planned so that every percentage-point of increment will be achieved primarily through the release of progressive new output.

The June CPSU Central Committee Plenum and the May and August (1986) CPSU Central Committee conferences noted that the current state of affairs in the area of developing equipment equal to the world's best is justifiably alarming.

Branch associations and enterprises increased their production of new equipment in the 11th Five-Year Plan. Individual enterprises were restructured to produce the most progressive types of machinery and equipment, units capable of increasing productivity many-fold. Among them were associations and enterprises in Leningrad, Ivanovo, Gomel, Odessa, Ulyanovsk and elsewhere.

At the same time, in objectively evaluating the work done, one must note that we did not resolve the primary task, that of reaching the world's highest technical level in all types of equipment and tools released. Up until quite recently, a majority of our scientists, designers and technologists hardly anticipated surpassing the world technical level when developing new equipment. The benchmarks used for comparative evaluation were often not the very latest foreign models.

These fundamental branch comprehensive programs were developed to fundamentally restructure branch technical policy: "Technical Level," "Quality" and "Reliability." These three programs represent a unified complex of measures to reach the world level. In the 12th Five-Year Plan, these programs anticipate improving the productivity of the equipment being released 1.5- to 1.6-fold and improving their precision 1.2-fold. We are to lower specific metals intensiveness by 12-18 percent and specific energy intensiveness by 7-12 percent over those five years. Product updating is to be accelerated. The proportion of series-produced output at the world level will be 86 percent (of total output) and 100 percent of all new output by 1990.

The programs define the basic directions, measures and concrete assignments for raising the technical level of series-produced and new output. A priority mix of products and promising technical-economic indicator values have been established through 1999. The entire priority products mix is to be at the forecast world-level promising indicators in 1990.

The branch programs are the basis for developing plant programs, whose content must be the primary content of the work of the scientific research institutes, special design bureaus and associations.

The products mix of forge-press equipment included in the "Technical Level" branch program takes into account the requirements of branches of the national economy which have different types of production: small-series, series,

large-series and mass production. On the whole, the products mix of priority equipment encompasses about 50 percent of all KPO [forge-press equipment] in terms of type-size and about 70 percent in terms of value.

The program defines specific time frames and job assignments, as well as technical-economic indicators for such types of forge-press equipment as various flexible manufacturing modules, machinery with numerical programmed control, automatic and semiautomatic lines, automatic cold- and hot-forging machines, cold-extrusion presses, automatic clear-blanking presses, swaging machines, and so on.

Implementation of the forge-press equipment program will enable us to reach the following indicators in the 12th Five-Year Plan: rolled metal saved -- 1.7 million tons, reduction in metal lost to shavings -- one million tons, operators freed for other jobs in forging and stamping -- 96,000, machine tool operators freed for other jobs in machine shops -- 112,000.

The ministry is paying top-priority attention to improving product quality. We have enterprises which have been producing well-made output consistently. Machine tools from the Ryazan Machine-Tool Manufacturing PO [production association], the Srednevolzhskiy and Orshanskiy machine-tool manufacturing plants and the Ivanovskiy Machine-Tool Manufacturing PO imeni 50th Anniversary of the USSR, jig-boring machines and gear cutters from the Moscow Jig-Boring Machines Plant, the "Krasnyy Proletariy" machine-tool manufacturing plant imeni A. I. Yefremov in Moscow and the Srednevolzhskiy Machine Tool Manufacturing Plant, presses from the Voronezh Heavy-Duty Mechanical Press Plant, and a number of other machines and machine tools have been competing successfully on the world market.

However, the overall quality of the output being produced by branch enterprises cannot be considered to meet contemporary demands.

The ministry has increased its efforts to carry out the CPSU Central Committee and USSR Council of Ministers Decree "On Steps to Radically Improve Product Quality." Gosstandard [State Committee for Standards] agency acceptance of finished products is being instituted at branch enterprises. As the experience of the "Frezer" plant in Moscow shows, setting up finished product acceptance in this way forces the plant leadership, technologists, foremen and workers to change their attitude towards quality. And it does not require any additional capital investment or special steps beyond the ability of the collective itself.

Much organizational work remains unfinished, both in the ministry apparatus and locally, on creating the conditions necessary to ensure the consistent release of high-quality output.

In order to bring domestic machine tool manufacturing to the leading frontiers, we face considerable work on increasing the creative activeness of branch science, on selecting and educating talented young specialists, and foremost the designers and technologists who will be creating the new equipment. This is a long process, and we need to be constantly involved in it.

After the April (1985) Plenum, several organizational steps were taken in the branch. Several new NPO [scientific-production associations] were created and some SKB [special design bureaus] became part of production associations. Some 85 percent of all branch scientists are now in organizations which are part of an association. Forces at some scientific research institutes have been regrouped. However, the restructuring of scientific-technical forces to resolve the fundamental tasks facing the branch is not yet complete. We face the practical task of elevating the role and increasing the responsibility of the lead institutes for the technical level of the output being produced, with increasing their activity in the areas of scientific and technical development which are revolutionizing the technology of machine-building production, with increasing operating efficiency. Technological planning organizations must exert an ever-increasing influence on production efficiency and on switching production to an intensive path of development.

Restructuring the use of the available scientific-technical potential also anticipates strengthening its material-technical base and using new forms of organization.

Ten percent of all capital investment in the 12th Five-Year Plan is being allocated to develop the pilot-experimental centers of enterprises and organizations, which is 2.5-fold more than was allocated in the 11th Five-Year Plan to acquire computer equipment. Branch enterprises and organizations are participating directly in the work of the interbranch scientific-technical complexes, and all engineering-technical personnel will have been switched over to the new wage conditions in 1986.

A number of problems and tasks involving accelerating the development of new-generation equipment are being resolved within the framework of the "Comprehensive Program of CEMA Member-Nation Scientific and Technical Progress Up To 2000." The times dictate the necessity of developing new forms of multilateral and bilateral cooperation more actively and fruitfully.

Thirty branch enterprises are already cooperating on the basis of direct ties. Two scientific-production associations have been created and are being operated jointly with the NRB [People's Republic of Bulgaria], the Soviet parties being the Ivanovskiy Machine-Building PO [production association] imeni 50th Anniversary of the USSR and the "Krasnyy proletariy" Machine Tool Manufacturing PO in Moscow. We have also organized the "Robot" Soviet-Czechoslovak association and the international "Interrobot" association. Questions of developing joint associations are being discussed with a number of CEMA member-nations.

The ministry has restructured its investment policy so as to actualize the party directive on production intensification. Top-priority attention is being paid to setting up branch enterprise retooling. More than a two-fold increase in capital investment over the previous five-year plan is planned in this area. This will enable us to update 12-15 percent of our fixed assets annually. For the 12th Five-Year Plan as a whole, 65 percent of the active portion of our fixed assets will be updated.

The speeches by M. S. Gorbachev at the June (1986) CPSU Central Committee Plenum and by N. I. Ryzhkov at the USSR Supreme Soviet Session paid a great deal of attention to increasing the intensiveness of fixed assets use. We are faced with switching ministry enterprises over to two- and three-shift operation. To this end, we anticipate removing a considerable amount of obsolete and obsolescent equipment from the current inventories and sharply altering the fleet structure by increasing the proportion of progressive, highly-productive equipment. The labor collectives and public organizations will be enlisted extensively in educational work and in solving a number of social problems.

The innovativeness, scope and complexity of the tasks facing us obligate machine tool manufacturers to solve branch management problems in a new way. The ministry has switched to a new management general plan, significantly reducing the number of management units in the primary link and creating new production and scientific-production associations, with a majority of the scientific-technical organizations now incorporated into associations. However, branch management reorganization questions cannot be considered fully resolved. Continued improvement in management, broader association independence and the development of cost-accounting relations are necessary. Beginning in 1987, five production association will be autonomously financed.

Now that extensive restructuring is underway in all spheres of activity, conducting the active personnel policy demanded by the 27th CPSU Congress and the June (1986) CPSU Central Committee Plenum merits particular attention. None of the above administrative and economic measures will have the necessary impact if any Ministry subdivisions, enterprises or organizations lack a stable staff of competent, energetic specialists and leaders capable of introducing everything new and advanced, people following high party principles, people able to work with others.

The human factor, mobilizing the creative activeness of enterprise and organization workers, must play a decisive role.

The Appeal of the CPSU Central Committee to the workers of the Soviet Union on widely developing nationwide socialist competition for successful implementation of the assignments of the 12th Five-Year Plan has met with strong approval in the labor collectives of our branch.

We are confident that all branch labor collectives will do everything necessary to carry out the tasks set machine tool manufacturing on accelerating scientific-technical progress and ensuring the retooling of machine building on a modern technical base.

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KRASNY BORETS' DIRECTOR ON PLANT'S PRODUCTS, GOALS

Moscow FOREIGN TRADE in English No 2, Feb 87 pp 28-30

[Interview with Anatoliy Miloserdnyy, director of Krasny Borets, by Boris Zlobin]

[Text] Machine tools made by the Krasny Borets Works in the town of Orsha are in operation today in 87 countries. They are well established in the FRG, Great Britain, France, Finland, Belgium, Austria, Japan, Italy, Canada. High quality, reliability and precision assure their popularity.

The works in Orsha was rewarded the diploma of the Presidium of the USSR Chamber of Commerce and Industry for its achievements, active participation in the Chamber's activities and the assistance rendered in the development of the USSR trade and economic ties with foreign countries.

Anatoliy Miloserdnyy, Director of Krasny Borets, answers our questions regarding the works and its products.

[Question] What are you main products?

[Answer] We manufacture expressly high precision surface grinders and specialized grinding machines. Mostly we supply Soviet industry but a good portion of our output is for the world market. During the 10th (1976-1980) and 11th (1981-1985) five-year plan periods a great variety of high precision grinding machines were designed and placed in mass production as I said, many are for export.

Our models ZE711F1, ZE711VF1, ZE721VF1-1, are for the precision surface grinding of parts made of various materials in individual, serial and large-lot production. Grinding in the vertical plane is also possible with a grinding wheel face.

Workpieces, depending on the material, shape and size can be held directly on magnetic or electromagnetic plates, in jigs or clamped directly to the table's surface.

Profile grinding of different workpieces is by a formed wheel which is dressed by various optional accessories supplied with the machines.

A semi-automatic machining cycle with a programmed vertical feed and digital indication of the table and the head displacement is possible with all models. Roughing and finishing feeds at pre-set rates, grinding down to the required size, truing, automatic grinding wheel reset and table return to the loading position are included into the cycle.

A luminous signalling system is available, which comes into action twice, the first time at the beginning of finishing feed and the second when the specified dimension is reached.

All operating controls are positioned according to ergonomic principles. The wheel head and the table slide have a plunge setting system.

All models are equipped with the necessary interlocking systems to ensure failure-free operation.

For easy servicing and to reduce vibration and thermal strain all controlling mechanisms, hydraulic and the electric equipment are positioned away from the machine's working parts.

[Question] The April (1985) Plenary Meeting of the CPSU Central Committee and the 27th Party Congress set the task to design new progressive machinery and technologies. How is the collective accomplishing this task? What new models can Soviet enterprises and foreign partners expect during the present 12th five-year plan period?

[Answer] The cardinal acceleration of scientific and technological progress is a strategic lever of the USSR's economic intensification; in this machine-building also plays a leading part. Our collective has a prodigious task of developing in the near future better machines capable of competing world standards.

For this we have already a long-term program for designing and introducing into production a new range of machine tools in 1986-1990 which we have designated as the D series. This program takes the customers' requirements into account and the latest technologies.

In the D series, semi-automatic machines account for over 40 percent, machines with numerical control for more than 18 percent, high and super-high precision machines—over 10 percent. The series will also include various grinding modules which can be built into flexible production systems.

The high technical level of the machines selected for mass production will be ensured by application of modern numerical control systems, controllable electric drives, wide use of contactless position sensing elements and digital indicators, and also by implementing such progressive finishing technologies as full-depth, electrochemical and diamond-erosion grinding.

We are improving the precision parameters of the new machines on the average 1.5 times. Already designed and in 1987, for the first time in our country, self-controlling surface grinding machine of the C class will be made. To meet home and foreign customer's requirements in full, the new series will

contain machines with table working surfaces of 160x300 mm, 400x630 mm, 500x800 mm. A microprocessor-operated numerical control system allows dialog programming.

The series will substantially increase labour productivity, diminish material consumption, improve grinding precision.

The aim of our collective is to fully meet the Soviet economy's needs for high-precision grinding machines, to stop future import of similar machines from the capitalist countries and finally to place our new models on their markets.

By the time 1990 comes around the works will have increased the output of numerically controlled machines five times, special machines twice, flexible production modules five times.

[Question] To reach these goals is possible only if new technologies are introduced at the works. What is the works doing in this direction?

[Answer] I must say, that during the 11th five-year plan period we put a lot of effort and allocated means for developing new production technologies and installing new equipment. This substantially increased labor productivity. Its growth during the previous five-year plan period equalled 135 percent, against the 129.6 percent envisaged by the plan. The whole production increment was gained due to the labor productivity growth.

For accomplishing these tasks our engineers worked out a special-purpose program which would reduce manual labor. Fulfillment of this program rendered manual labor virtually absent.

Besides our specialists, engineers and scientists in 16 research and design institutes helped draw up this program and execute it, which made it easier to solve difficult development problems, introduce new technologies quicker and obtain better end results.

The problem of metal mold durability was solved by means of plasma spraying a heat-resistant coating on the mold's contacting surfaces. This process doubled the mold working life.

To improve technologies and shorten time required for their development, our works uses the computer aided design (CAD) system. CAD reduced development time 2.5-3.0 times.

There are many similar examples but it seems to me, we mentioned enough for you to see how we at the works, together with scientists improve our activity from the efficiency point of view as well as labor productivity and product quality.

[Question] You mentioned cooperation between your works and research institutes. Could you say, how your specialists improve technologies?

[Answer] I must say that our specialists and engineers have done a lot to upgrade existing technologies, and are continuing this work today. Seven inventions and 827 rationalization proposals introduced by the Krasnyy Borets engineers and workers into production during the 11th five-year plan period have saved 1,929,000 rubles. As a result, the labor intensity of products has been reduced many times.

The works inventors, for example, designed a reciprocating hydraulic drive. This invention saves the works some 400,000 rubles annually.

Another invention—a control device for the reversing gear of the surface grinding machine's work table—was worth about 30,000 rubles to the works.

No doubt, during the 12th five-year plan period new machines will need further development plus introduction of new technologies and equipment to ensure qualitative machine production. We are developing the production base, automation and robotization.

[Question] Do you cooperate with foreign firms?

[Answer] At present we undertake cooperated production with the West German firm Elb-Schliff and the French firm IZL. This wider cooperation with foreign firms is helping us set up very productive technologies and equipment in a much shorter time.

The foreign currency, which the works earns for the export of its products, is used to purchase high-tech equipment. Today at the works the share of modern equipment accounts for 42 percent, and by the end of the current five-year plan period it will reach 58 percent.

It is necessary to point out that our cooperation with the firms Elb-Schliff and IZL is fairly close and successful and is of mutual benefit. I think that both firms are interested in furthering this cooperation.

Up to 500 of our machines are exported annually. And the biggest share (up to 100 machines) is sent to the firm Elb-Schliff (FRG). I hope, in future, we'll manage to broaden our cooperation with this firm. Especially as the export of surface grinding machines is to be doubled. In the near future we will start exporting the D series machines and special models of them (ZD721AF1-1, ZD710V-1, ZD710VF1-1, OSh300F2, OSh400F2).

Deliveries to customers of a sizable quantity of complex grinding equipment requires a high level of technical servicing. Spare deliveries are properly planned and we have never had any complaints or grumbles about them. It's our tradition to give immediate attention to any technical servicing problem, using all the means at our disposal. However, analyzing information sent by our specialists stationed abroad we found out some weak points in our service, mostly delays in deliveries of spare parts. This is a problem we have to mutually solve with a number of other organizations. It would be correct if Soviet organizations follow practices worked out by foreign firms and accepted by the customers.

In conclusion I would like to express the hope that our international trade, technical and scientific ties will strengthen and develop, and our exports will grow. Our relationships with foreign partners are good, and we feel sure they will be purchasing greater quantities of our products.

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"KRASNYY PROLETARIY" PLANT'S NEW FACILITY PRODUCES ROBOTS FOR MACHINING

Moscow PRAVDA in Russian No 52 (25039), 21 Feb 67 p 2

[Abstract of article by O. Mikhayev, Moscow]

[Abstract] The article reports on a new facility of the Moscow "Krasnyy proletariy" Plant which is equipped with a flexible production system. Called one of the country's largest and most perfected flexible systems, it consists of computerized, robot-equipped machining centers. Robots for tending machine tools are produced at this facility. It is said to have the largest capacity for producing this type of robot—6,300 annually. The facility, which is in a building separate from the plant's old building, in the Novyye Cherenushki district of Moscow, turned out 2,800 robots last year, and the target for this year is 4,500. This production capacity is said to be equal to that of a large machine tool building plant, and yet the facility employs only 47 machine operators. The flexible system operates around the clock. On the first work-shift, 25 operators are on hand to prepare equipment for the day's work. On the second shift, the number of workers is cut back to 12-15, and only 5-7 are on hand during the third shift.

The robots produced with the flexible system reportedly are being exported in sets with machine tools to other socialist countries. There is a newer robot model with certain characteristics that are said to be superior to those of the best robots in the world. It is a joint development of Soviet and Bulgarian designers cooperating in the international association "Krasnyy proletariy—heroye." In addition to tending machine tools, it can weld, paint, rivet and even perform some assembly operations. Series production of this model is supposed to begin in 1968.

The article also raises questions of moving ahead with work to perfect the technology of the flexible production system, calling the new facility a touchstone for testing the readiness of the country's machine building to take a qualitative leap on the world level. It is mentioned that the system uses both domestic and imported equipment, and that the Soviet equipment matches the imported equipment in all respects except reliability. Singled out for a comparison in the article is the SW-1420 computer produced by the Ministry of Instrument Building, Means of Automation and Control Systems, which can be used for controlling the flexible system. This computer reportedly requires 8-12 service personnel, depending on the number of shifts it is operated; on

the other hand, there is an imported computer that can control the system around the clock without any service personnel. It is also noted that the SM-1420's mean time between failures, at 3,000 hours, compares unfavorably with the foreign counterpart. Also criticized are numerical-control devices for robots supplied by the instrument building ministry's "Kontur" association in Tomsk and "Telemekhanika" association in Nalchik.

Quoted in the article are Yu. Kirillov, who was recently elected general director of "Krasnyy proletariy," and the plant's chief designer, V. Galkin.

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NEW ARMENIAN COUNCIL COORDINATES WORK ON ROBOTICS

Yerevan KOMMUNIST in Russian No 248 (15927), 26 Oct 86 p 1

[Excerpt from article: "Armenian Academy of Sciences' Council on Robotics"]

[Excerpt] Imagine a plant where a central computer accomplishes overall supervision of the designing of a new product, and then translates the specifications into the language of instructions that can be understood by robots. Such a notion is no longer the subject of fiction. A new robotics complex has gone into operation in the assembly shop of the Yerevan Electrical Equipment Plant. Robots installed on the assembly line will assemble electric motors, replacing dozens of workers. This complex was developed at the scientific research institute "Elektromash," but its creation actually is the fruit of a collective effort by scientists and specialists of the scientific council "Robots and Robotic Complexes," which has been organized under the presidium of the Armenian Academy of Sciences.

"Our republic's economy includes such key industries as machine building, machine tool building, electrical equipment, and precision instrument building. These are all areas of industrial production that can benefit to the maximum extent from wide introduction of robotic systems," said the chairman of the scientific council, corresponding member of the Armenian academy G. Areshyan. "The situation with introduction of industrial robots, automatic lines and automated production facilities in the republic, however, does not satisfy modern requirements. The extent of their application is rather limited.

"The scientific council 'Robots and Robotic Complexes' has been created to coordinate work and to summarize leading experience and scientific advances in this field. Acting as base organizations of the council are leading research and production organizations of industries that are interested in introducing robots. A comprehensive targeted program has been compiled for introducing robotic complexes and flexible automated production facilities.

"I would like to illustrate the possibilities that exist for coordinating and integrating the efforts of robotics engineers with the following example. At one of its meetings, the council was reviewing an order from the Moscow Power Engineering Institute for development of a certain device for a flexible automated production facility (GAP) that was being designed. After discussing

the order, members of the council came up with a counter-proposal: instead of just the one device, develop all of the equipment, assemblies and parts of the GAP. The proposal didn't remain on paper: a temporary team of scientists and specialists in the field of kinematic mechanisms and programs for control of complex robots was organized. In a short time this team was able to draft a technical assignment and start development work."

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FINNISH FIRM HELPS ROBOTIZE INSTRUMENT ASSEMBLY LINE

Moscow IZVESTIYA in Russian No 315 (21757), 11 Nov 86 p 1

[Article by L. Garipova, Smolensk]

[Text] An assembling center equipped with robots has been created jointly by the "Nokia" firm of Finland and the research-and-production association "Tekhnopribor" of Smolensk. This center represents the first major project within the framework of an agreement on cooperation in the field of robot-based flexible production lines, automated equipment and computer technology that the Finnish firm has with the USSR Ministry of Instrument Building, Means of Automation and Control Systems.

Ammeters, voltmeters and other electrical measuring devices are used widely in many branches of the economy. The modular system that has been jointly developed is intended for assembling them. In this system, components of the products are delivered to the assembly table of a robot-manipulator, the "Nokia Puma-560." It takes the parts, and its 'brain' identifies the base components and the components that are to be joined to them. Commands in the form of pulses regulate the force of its mechanical 'hands' in attaching fragile parts such as thin metal pointers and glass.

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IMPROVED MECHANISMS FOR ROBOTS

Vilnius SOVETSKAYA LITVA in Russian No 246 (13159), 24 Oct 86 p 4

[Excerpt] Specialists of the Kaunas Polytechnical Institute (KPI) have designed a series of mechanisms which open up broad possibilities for development of new-generation technology and automated production sections and shops.

New industrial robots are intended for automating auxiliary manual work, others are for producing precision parts, while still others will become indispensable in dyeing shops. As compared with robots now in use, the new ones manipulate more quickly and flexibly and with greater precision.

"The very complex problem of providing the robots' actuating systems with capabilities that can more nearly match those of their control systems has been solved in collaboration with specialists of KPI's chair of automation," said Yuozas Rudzyanskis, docent of the institute's chair of machine tools. "As a result, the robots now carry out commands better and move along more complex paths. This is very important from the standpoint of preparing them for operation in flexible production systems and automated sections."

A series of components for industrial measuring robots has been designed under the direction of Professor Ramutis Bantsyavichyus at the institute. These robots will monitor parameters of sophisticated instruments and precision machinery, taking the place of tens of thousands of people who are now engaged in measuring work.

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PROCESS CONTROLS, AUTOMATION, ELECTRONICS

REGIONAL SERVICE CENTER ESTABLISHED FOR NC AND ROBOT EQUIPMENT

Moscow IZVESTIYA in Russian No 25 (21832), 25 Jan 87 p 1

[Article by correspondent V. Kulagin, Orel]

[Text] A regional center for servicing machine tools with numerical programmed control and also robotic complexes has begun to operate at the Orel Machine-Tool Repair Plant.

"The area served by this center takes in Orel, Kursk, Bryansk, Lipetsk and Tula oblasts," related V. Stavtsev, director of the plant. "It wasn't just luck that our plant has become a leader in servicing equipment with electronic instrumentation. Four years ago, we created a group of N/C machine adjusters and opened a section to do work for plants of Orel. But soon, heads of plants in neighboring oblasts also contacted us with requests to debug N/C machine tools."

The Orel center for servicing equipment with electronic circuits is broadening its scope--affiliates of the center are being created, its material and technical resources are being strengthened, and the quality of its services is being improved. The volume of work at the center will almost double this year as compared with last year.

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MACHINE TOOL MINISTRY ACTS TO IMPROVE PERFORMANCE OF ROBOTS

Moscow SOVETSKAYA ROSSIYA in Russian No 26 (9277), 1 Feb 87 p 1

[Excerpt from article by I. Ordinartsev, first deputy minister of Minstankoprom]

[Excerpt] The Ministry of the Machine-Tool Building and Tool Industry (Minstankoprom) has discussed the article with the title "Robot on the Assembly Line" which was published in the newspaper "Sovetskaya Rossiya" for 16 Sep 86, and considers this article's criticism of the ministry to be correct. This criticism involved questions of introducing and using industrial robots. In particular, the article correctly posed the question that economic benefit from utilization of industrial robots must be calculated in each specific case of their employment.

Users' complaints that industrial robots are not reliable enough have also been found to be justified. Minstankoprom and the ministries of instrument building, means of automation and control systems, and the electrical equipment industry are now working jointly to raise the technical standards, quality of workmanship and reliability of industrial robots. A proving facility for reliability testing of experimental and series-produced models has been organized for this purpose. Work is being done on studying the reliability of robots in real operating conditions. Incoming control of sets of components has been introduced at a number of plants which produce robots, such as the "Krasniy Proletariy" Machine-Tool Building Production Association in Moscow. A state standard which is in effect as of January 1987 calls for mandatory burn-in of each robot for at least 32 hours before it is submitted for tests.

The Interbranch Scientific-Technical Complex "Robot" has been created for the purpose of eliminating shortcomings in interagency organization of work. The main task of this complex is to develop industrial robots intended for various production processes, for use in robotic complexes, flexible production modules and automated production lines. Drafting of rules for a system of maintenance services is another task that is included in the complex's plan of work.

Questions of raising the technical standards of industrial robots and robotic equipment, advancing their production and introducing them in the industry during the 12th 5-Year Plan were examined at a meeting of the board of Minstankoprom. Decisions adopted by the board are aimed at detailed revision

of the types of industrial robots in production, delineation of the specializations of design organizations and manufacturer-enterprises, and formulating a specific program for raising the technical standards of robots and robot-equipped production complexes.

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ROBOT FACILITY FOR MACHINING EXCAVATOR PARTS

Moscow ENERCOMASHINOSTROYENIYE in Russian No 1, Jan 87 pp 39-41

[Article by N.P. Pyrkov, engineer]

[Abstract] Organization of a robot facility for manufacturing purposes is demonstrated on the example of such a facility which produces fastening bolts for EKG-8/10/12 excavators. It consists of a model 2 "Brig 10B-MK" industrial robot which operates a lathe with a hydraulic pantograph and is program-controlled through an appropriate interface. A major problem in development of this facility for a relatively small-scale production was design of the gripper with adequate capacity for transfer of blanks and finished parts 20-60 mm in diameter and 50-300 mm long at rates of 40-100 pcs/h. The hoist assembly includes a ratchet mechanism with a conveyor carrying 46 baskets and a control box, for operation in the fast loading mode or in the slow holding mode. The facility is equipped for cyclic operation, automatic operation, and "manual" adjustments from a transportable control panel. It has been designed for optimum performance on the basis of applicable productivity and reliability analysis. The positioning error does not exceed 0.5 mm. Only one human operator is required for supervision and maintenance of four such robot facilities in a plant. Figures 4.

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TWO-CHANNEL LOW-FREQUENCY MODULE OF MODULATION RADIOMETERS FOR POLARIZATION MEASUREMENTS

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 5, Sep-Oct 86 (manuscript received 26 Mar 85) pp 8-11

[Article by Ch. Seitnepesov, B. Rakhmanov, A. Abdyrakhimov, K. Rizayev and A. Khanberdiyev, Institute of Engineering Physics, TuSSR Academy of Sciences]

[Abstract] A low-frequency module of a modulation radiometer for measuring the Stokes parameters of nonthermal cosmic radio emission on a two-channel

polarimeter is described, its function being to extract 1 Hz amplitude modulation and 20 Hz phase modulation signals for their subsequent amplification and conversion necessary for such measurements and polarimeter control. The module consists of two identical channels, namely, a total-intensity channel and a phase channel, each giving an analog output to a recording instrument and to a computer. Each channel consists of a tuned input amplifier with gain control, a synchronous filter-detector, a synchronous integrator with d.c. amplifier, a phase shifter for controlling the reference voltage, and an overload monitor. Other components, common to both channels, are a generator of modulating pulses with synchronizer and a shaper of phase-shifter control pulses as well as of time-base pulses. The module is designed according to the classical "variable-gain amplifier - synchronous filter-integrator" scheme. All components are built with series K284UD1B integrated-circuit chips of a low-noise high-stability differential amplifier, series K140 microcircuit chips, and series K155 digital microcircuit chips. The module contains also KT3102G and KT807A transistors. Its performance characteristics are minimum gain of $5 \cdot 10^3$ in the input amplifier, minimum transmission coefficient of 20 dB and maximum intrinsic noise of 20 μ V in the integrator, and time constant of the integrator adjustable to 10, 40, 100 ms, 1, 4, 8, 16 s. The module operates from a ± 12 V voltage supply, drawing a current of not more than mA. Figures 2; references 4: all Russian.

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STANDARDIZATION OF FMS, OTHER AUTOMATED SYSTEMS URGED

Moscow STANDARTY I KACHESTVO in Russian No 10, Oct 86 pp 10-13

[Article by Candidate of Technical Sciences L. P. Tolstykh, head of the Administration of Machine Tool and Tool Building Industry and Interbranch Production Facilities, USSR State Committee for Standards, under the heading "Production Automation and Robot Engineering": "Standardizing Flexible Manufacturing Systems"]

[Text] Automating machine-building production by introducing advanced technological processes and flexible readjustable complexes is one of the main tasks set machine-building by the resolutions of the 27th CPSU Congress. The Congress documents and recent party and government decrees set forth measures to accelerate the retooling of existing enterprises and the creation of technically sophisticated production capacities through the introduction of progressive technologies, flexible automated systems, and leading production organization methods which permit technological equipment to be operated with limited participation by attendants and rapid production readjustment to release new products.

The accelerated retooling of industry through extensive introduction of flexible manufacturing systems (FMS) is possible only given coordinated action by the branch ministries.

The Ministry of Machine Tool and Tool Building Industry has been entrusted with the functions of lead ministry for conducting a unified technical policy in the area of developing, manufacturing, introducing and servicing FMS at machine-building and metalworking enterprises.

Together with the USSR ministries and departments concerned, the USSR State Standards Committee and the Ministry of Machine Tool and Tool Industry is to ensure the development of normative-technical documentation on unitizing and standardizing flexible manufacturing cells (FMC) and systems, including documentation on standardizing flexible manufacturing systems during 1986-1990, documentation to include basic normative-technical terms and definitions documents, indicator classification and nomenclature, rules for accepting FMS, assembly components, fittings and tools, maintenance and repair, and methods of calculating the economic effectiveness of FMS and FMS control systems. The development of NTD [normative-technical documents] for this complex will

permit the creation of a unified normative-methods base which will ensure technically sophisticated, modular-unit FMS and the specialized manufacture of very reliable FMS and FMC elements.

Development of this NTD complex must be coordinated with work planned for the 12th Five-Year Plan to continue developing and improving the YeSTPP [Unified System of Production [Process Planning], the system of CAD and Automatic Control standards, the reliability program, and also the programs for comprehensive standardization of equipment, fittings, tools and industrial robots.

This system of FMS standardization documents is expected to include 78 normative-technical documents covering 40 state standards and 38 guidelines. The main NTD developers will be the Ministry of Machine Tool and Tool Building Industry and other ministries.

Development of this set of documents will ensure the development of principles for unitizing FMS based on parametric series for flexible manufacturing cells (FMC) and standard circuits for special-purpose FMS, optimizing FMC and other FMS element type-sizes, achieving good reliability indicators by assigning specific indicator values to individual FMS component elements, creating prerequisites for setting up specialized production of both the FMS as a whole and its individual elements.

The NTD comprising the set of FMS standardization documents will be developed along the following priority lines.

Developing the requirements for the principles of FMS development anticipates developing normative-technical documentation on the terminology, classification and nomenclature of quality indicators and general safety requirements. Moreover, the goal is to create a number of normative documents whose purpose is to establish the composition, structural principles and functional designation of the individual structural elements, the interconnections of standard structures, the methods of calculating indicators, the types and coverage of the technical documentation, the basic principles of metrological support, the methods of calculating economic effectiveness, and indicators and methods for evaluating the organizational-technical level of FMS. For example, the methods instructions (Technical Documentation. Types and Coverage) regulating requirements on the composition and content of design, acceptance-release and operating documents; methods instructions (Development Demands. Basic Provisions), determining the principles for setting up standard FMS structures which are optimum from the viewpoint of economic impact achieved at a specific production facility when FMS are introduced. The goals of optimizing FMS structures as applicable to the concrete production conditions they are being developed for are served by the development of a list of indicators and methods of evaluating them, of methods of calculating FMS economic effectiveness.

The development of assembly component requirements will have four aspects: requirements for flexible manufacturing modules will be provided by the development of normative-technical documentation on the types, basic parameters and specifications for automation equipment, FMC functioning and operation, as well as NTD for specific types of FMC which establish their

basic parameters and interfaces to other FMS elements. Moreover, we anticipate the development of state standards for the types, basic parameters and mounting dimensions of the FMC which will ensure that a broad spectrum of production operations can be performed by the FMS, including jig-boring, turning, cylindrical grinding, sheet stamping, casting and forging, injection molding, precision and arc welding, electrothermal and plasma treatment, and painting and varnishing.

Development of the type-sizes of the main FMS elements (FMC, transport and warehousing equipment, electric robot cars, and assembly components for them) is also anticipated; FMS functional support system requirements include the development of normative-technical documentation establishing demands on metalworking and auxiliary tools, fittings, accessory tables for securing blanks, electric robot cars, and so on.

Much attention will be paid to developing NTD for automated storage/retrieval systems (AS/RS), which are a most important GPS element and one necessary to unify the individual FMC into a single automated flexible manufacturing system. We anticipate the development of standards defining the AS/RS classification criteria and the classification principles, types, basic and mounting parameters and dimensions, as well as methods instructions on AS/RS simulation modelling to determine the optimum AS/RS parameters when designing FMS to perform specific production tasks; general provisions and requirements on flexible manufacturing systems control include normative-technical documentation on terms and definitions for the control systems, their classification, structure and functions, EVM-UChPU [general-purpose MC computer] communications channels, hardware components, lingua franca and software of the control systems. A number of documents are being developed from existing multipurpose YeSS ASU [Automatic Control Unified standards system] standardization programs such as standard procedures for developing and introducing FMS control systems, methods instructions on control systems information support, and methods instructions on the structure and composition hardware components in FMS control systems; assembly components and materials requirements for flexible manufacturing systems include the development of normative-technical documentation on FMS electric drives, control devices, communications cables and electric motors.

Classifying the arrangement of flexible manufacturing systems by type [typification] anticipates the development of normative-technical documents for the common FMS layout requirements and standard arrangements of FMS with different production designations, including those for machining, casting in disposable sand molds, die and chill casting, forge and press production, powder metallurgy, painting and varnishing, welding, and printed circuit board manufacturing.

Requirements for organizing flexible manufacturing systems.

This area encompasses the development of normative-technical documents which include requirements for simulating FMS structures and processes, simulating the organization and operation of machining processes and standard software, the required composition and content of the documents in force in the system,

as well as FMS ergonomic requirements. We anticipate the development of feasibility-study methods which will include the methods of shaping technologically homogeneous groups of parts whose processing using FMS will permit a substantial increase in the effectiveness of enterprise operation in terms of end product released.

The development of regulations and codes for ensuring operating reliability. These include flexible manufacturing system maintenance and diagnostics documents on the most essential aspects of the problem of ensuring FMS reliability. The fact that reliability topics are grouped into a separate line of FMS standardization work results from the complexity of the problem and the necessity of a comprehensive approach to its solution. In this particular instance, the complexity of the problem of reliability is determined by the complexity of FMS as systems consisting of a large number of interconnected elements and, at the same time, subsystems of higher-level systems (the flexible automated sector, shop, and so on).

A high level of reliability (trouble-free operation) is required of all system elements and all links among them for the indicated systems to function at a prescribed efficiency under automatic conditions, that is, with minimal participation by the human operator, who, in traditional (nonautomated) technological systems, has performed a whole series of functions ensuring that the system performs its designated function. Poor FMS and FMS element reliability is the main obstacle to the extensive introduction of automated production facilities and so-called "unmanned" or "low-manned" technology into machine-building, since the high cost of FMS and higher-level systems can be recompensed and create a profit only on the condition that they work trouble free for a time determined based on economic effectiveness criteria.

FMS reliability, like the reliability of any other item, is ensured first of all in the development stage. In this regard, such specific FMS features as an indistinct connection between the individual modules and subsystems (one module's malfunctioning does not necessarily cause the FMS as a whole to stop operating), the ability to diagnose the status of the elements and replace malfunctioning elements while in an automatic mode, and the possibility of structural-functional backup (in the form of automatic control programs and readdressing objects of labor to modules which remain operable), permits improved reliability of the FMS as a whole, not only by increasing the reliability of the individual elements, but also through appropriate circuit design when developing the system.

In order to create an FMS with a prescribed level of reliability, methods of calculating reliability need to be developed which permit evaluating the effectiveness of particular circuitry and component design, as must methods of testing and monitoring the reliability of physical FMS models and their elements, both in the development stage and when they are operating under production conditions.

The level of reliability invested in FMS through their design and manufacture, confirmed by calculations and experimentally, must be retained throughout the operating period. This must be facilitated by establishing a maintenance and

repair procedure which imposes specific obligations on both the manufacturer and the consumer of the FMS.

In view of the indicated features of the problem of FMS reliability, we anticipate the development of standards and methods instructions regulating the criterion of FMS malfunctions, monitoring and diagnostics equipment, a nomenclature of reliability indicators for FMS modules and other elements which is a function of the designated technological purpose of the modules, the organizational structure of the FMS, the level of automation, type of production and production conditions. We also anticipate developing methods of calculating, monitoring and testing FMS reliability and FMS maintenance and repair procedures.

The development of standards for the nomenclature of flexible manufacturing module reliability indicators anticipates the use of such indicators as "installed trouble-free output" (Tu) and "technical use factor" (Kt.i.) as the basic standard-setting reliability indicators. Used together, they permit a level of trouble-free service necessary for effective FMS functioning in their designated technological area, not only by increasing the trouble-free service life of the system elements, but also by improving the organizational-technical level of FMS operation. In this regard, it becomes possible to determine for each specific instance an optimum combination of Tu and Kt.i. values which minimize total losses connected with system downtime due to malfunctions or in connection with scheduled maintenance and repair.

The NTD will adjust Tu and Kt.i. values for FMC for different technological purposes, as well as Kt.i. values for such FMS elements as numerical programmed control systems, storage/retrieval systems, industrial robots, electrical equipment, hydraulic and pneumatic equipment, computer equipment, electric robot cars, and microcomputers for programmed-control systems.

GOST 26228-85, "Flexible Manufacturing Systems. Terms and Definitions," has already been approved and 20 NTD such as "Flexible Manufacturing Systems. Indicator Nomenclature," "Flexible Manufacturing Systems. Classification," "FMS Control Systems. Information Support," and others, have been developed and are scheduled for approval in 1986.

The precise norms and rules established in the FMS standardization documents will permit creation of the normative-technical base necessary to comprehensively automate production processes in the main branches of machine-building.

The economic impact of introducing this particular NTD complex will be realized by increasing the productivity of equipment built into the FMS 1.5- to two-fold, increasing the shift index of FMS equipment operation up to 2.5-fold, increasing labor productivity five- to eight-fold, and lowering output net cost by 9-11 percent. The total economic impact of introducing these NTD, including the three- to four-fold reduction in FMS development and introduction time and in planned FMS release in the 12th Five-Year Plan, will be roughly 600 million rubles.

Moscow STANDARTY I KACHESTVO in Russian No 10, Oct 86 pp 15-20

[Article by R. M. Mironova: "Pressing Problems of Robot Equipment Standardization"]

[Text] With the participation of representatives of Krasnoyarskiy Kray industry and VUZ's and other regions of the country, a joint enlarged meeting of the Gosstandart [State Standards Committee] "Industrial Robots and Robotized Technological Complexes" NTS [scientific-technical council] section and the Council to Assist Scientific-Technical Progress attached to the Krasnoyarsk CPSU kraykom was held from 11 June through 13 June 1986 in Krasnoyarsk. About 200 people from 12 branches of industry participated in the work of the joint meeting. The chairman was V. V. Tkachenko.

VNIINMASH [All-Union Scientific-Research Institute of Normalization (Standardization) in Machine Building] Deputy Director B. N. Volkov spoke on "Standardization Tasks in the Field of Industrial Robot Engineering."

After briefly describing the tasks set machine building by the 27th CPSU Congress, the speaker noted that standardization is being given an important role in resolving them, particularly in production automation, a key area in the development of modern machine-building.

In machine building, production automation is an independent, complex task associated with the development of modern new equipment, technological processes and production organization systems, with systematic improvement in working conditions, and with reducing manpower requirements.

Automation effectiveness can be ensured only given a comprehensive approach to developing and introducing industrial robots, machining equipment, control devices, auxiliary mechanisms and devices, and so on.

Industrial robots are being widely used, in machine-building and also in mining, metallurgy, agriculture, construction, transport, the services sphere, and so on.

Given this situation, we need to establish an overall technical concept and ensure a unified technical policy for all stages in the life cycle of industrial robots, both among the USSR ministries and departments and among the CEMA member-nations. Standardization must, the speaker noted, be the basis of technical policy in industrial robotics.

Work on standardizing and unitizing industrial robots here is being done within the framework of the "Comprehensive Industrial Robot Standardization and Unitization Program" which is linked to the comprehensive program to solve the corresponding scientific-technical problem, as approved by the GKNT [State Committee for Science and Technology].

The comprehensive standardization program anticipates the development of normative-technical documentation on industrial robots and robotized technological complexes of various types.

The fundamental standards establishing the terminology, classification, the nomenclature of basic indicators, specifications, and also the methods of accepting and testing industrial robots were developed from 1981 through 1985.

We are currently developing state standards regulating specifications, types, basic parameters and mounting dimensions of the individual IR [industrial robot] units and actuating modules. Introduction of these standards will enable us to switch to a unit-module system of building industrial robots.

Continuing, the speaker noted that metrological support for the development, manufacture and operation of industrial robots, as well as standardization of the methods and means of testing them plays an important role in ensuring a high technical level and quality. Implementation of the Gosstandart NTS resolutions in these areas began in 1986. Particular attention is being paid to standardizing the methods and means of accelerating the testing of industrial robots and assembly components for them, to ensuring the accuracy, reliability and reproducibility of the test results, to standardizing the algorithms for making decisions on IR conformity to preset requirements.

Implementation of the assignments of the comprehensive industrial-robot standardization program will permit regulating their development and limiting the number of new models, ensuring the interchangeability of individual assembly and other components, and creating a basis for unitized, building-block and specialized production.

Candidate of Technical Sciences S. F. Rasstrigin (CEMA Standardization Institute) reported on "CEMA Industrial Robot Standardization." In particular, he noted that the changeover of the main branches of the national economy to a level of highly mechanized and comprehensively automated production is one of five priority directions of economic intensification anticipated by the "Comprehensive Program of CEMA Member-Nation Scientific and Technical Progress Up To 2000."

Solving the problem of automating industrial production through the extensive introduction of industrial robots and flexible manufacturing systems will permit a reduction in the time involved in incorporating and expenditures on producing new types of output in CEMA member-nations, an increase in labor productivity in machine building, and higher equipment loads and shift indexes.

Industrial robots are most widely used in CEMA member-nations to service metal-cutting machine tools, foundry and forge-press equipment, performing mainly transport and loading operations.

Continued improvement in industrial robots will be associated with increasing the release of more-sophisticated models, with increasing their versatility and with using unit-module components.

In connection with their increasingly mass production and the increase in delivery volumes, ensuring the technical compatibility of industrial robots being developed by different countries puts forward strong demands for standardization and unitization, both of the robots themselves, and of their components. Within the CEMA framework, the speaker said, industrial robot standardization is being done under the 1983-1990 comprehensive robot equipment standardization program approved by the 90th Session of the CEMA Permanent Commission on Machine-Building.

One of the most important problems connected with the development, production and widespread use of industrial robots and robotized complexes is the training and retraining of engineering personnel in the corresponding specialties. Krasnoyarsk Polytechnical Institute prorector S. A. Podleskiy talked about how this problem is being solved at his institute. Since 1983, the institute has been opening up new specializations within its existing specialties; the institute has developed a comprehensive "Robot Equipment Systems and Flexible Manufacturing Systems" program which is an integral part of the kray program; the industrial enterprises and it are creating an interbranch study-research complex.

Continuing, the speaker talked about the problems still ahead in training and retraining personnel for robot engineering and put forward a number of interesting proposals.

Doctor of Technical Sciences A. P. Dambrauskas spoke on Krasnoyarsk Polytechnical Institute participation in the development of flexible manufacturing systems at kray enterprises.

S. S. Anshin (ENIMS [Experimental Scientific Research Institute of Metal-Cutting Machine Tools]) presented two reports at the section's enlarged meeting. The first was devoted to the activity of the "Robot" interbranch scientific-technical complex (MNTK) — ENIMS is the lead organization for this complex.

The primary task of the MNTK is to develop various industrial robots for use as part of robotized complexes, flexible manufacturing modules and automatic lines. It is working primarily on conducting and coordinating domestic fundamental and applied research, pilot-design and applied work the development of world-class industrial robots, manufacturing prototypes and putting them into series production in cooperation with the ministries and departments.

The Minstankoprom [Ministry of Machine Tool and Tool Building Industry] is currently developing a 1986-1990 five-year plan and coordinating it with implementing organizations. This plan includes work aimed at ensuring a unified robotics technical policy, unified research and development, and unified development of promising industrial robots and assembly components.

In the second report, "Ensuring Industrial Robot Compatibility With Technological Equipment," S. S. Anshin focused the attention of the seminar participants on the fact that accelerating the introduction of industrial robots and increasing the effectiveness of their use depend substantially on

meeting a number of requirements designed to ensure the compatibility of robots with technological and auxiliary equipment. These include requirements on:

- technological and auxiliary equipment designs, due to the requirement that they operate with industrial robots, as part of robotized technological complexes;

- setting up the interchange of signals between technological and auxiliary equipment and the industrial robot;

- parametric compatibility between technological and auxiliary equipment and the industrial robot.

The demands on the first group are by now reflected quite well in the existing normative-technical documentation, so the report focused mainly on the other two groups.

In particular, the speaker examined questions of standardizing signals between IR and technological and auxiliary equipment, of choosing the most appropriate signal-exchange circuits, and he presented the general electrical circuitry requirements of the exchange.

The speaker noted that parametric compatibility, that is, the fullest correspondence between the parameters of the IR and the equipment they service, is assuming increasing importance. The report presented a top-priority list of parameters which must be brought into line with each other (precision, productivity, reliability) and considerations on assigning numerical values to them.

"Systems Approach to Organizing and Conducting Industrial Robot Tests" was the topic of a report by Candidate of Technical Sciences L. N. Aleksandrovskaya MAI [Moscow Aviation Institute imeni Serge Ordzhonikidze].

Industrial robots and robotized technological complexes are technical systems characterized by considerable structural complexity, the diversity of functions performed and the concomitant nonhomogeneity of partial indicators of effectiveness, and the contradictory nature of the requirements for these indicators. The testing of such systems under actual operating conditions, which is done to evaluate effectiveness indicators and confirm the demands on these indicators, involves considerable expenditures of time and funds, especially when using statistical effectiveness indicators such as precision, reliability and probability of performing the task. It is therefore not possible to collect the homogeneous statistical material needed for precise evaluations or reliable confirmation of the demands only by operating-conditions testing.

In this connection, the speaker noted, interest is currently increasing in testing systems planning, in which all tests done when developing complex technical systems are viewed as a unified process aimed at ensuring preassigned item characteristics.

With such an approach, the content and volume of the individual types of testing are determined so as to reflect specific tasks of each stage of product development, so the testing of the different stages is not redundant,

and so the development process as a whole ensures the production of industrial robots with assigned characteristics at efficient expenditures of time and funds. The connection between the individual stages of development is thus made by recording and combining item-characteristics information from all the stages.

The report then noted that it is either technically impossible or economically inexpedient to test complex technical systems with a high degree of statistical reliability for all prospective operating conditions. The fact that the item will operate satisfactorily in the entire range of operating conditions is demonstrated by a simulation technical analysis. If the test results confirm the analytical prediction at several critical points, the prediction is then assumed to be correct for all remaining points. By combining the information, such an approach permits a substantial reduction in the amount of operating-conditions testing.

The report by T. M. Sholukhi, TsNIIRTK, [Central Scientific Research Institute of Robotized Technological Complexes] was devoted to metrological support for the development, manufacture and operation of industrial robots, robotized technological complexes and flexible manufacturing systems.

A report on enterprise experience in using industrial robots was met with great interest among participants in the enlarged meeting.

Candidate of Technical Sciences F. S. Ioffe (VNIPTMASH [All-Union Scientific Research, Planning and Design Institute of Hoisting and Conveying Machinery, Loading, Unloading and Warehouse Equipment and Containers]) spoke on the use of industrial robots and manipulators to automate and mechanize materials-handling and storage/retrieval jobs at enterprises of the Mintyazhmash [Ministry of Heavy and Transport Machine Building].

Currently, the speaker said, the institute is developing and submitting for industrial production a number of 100-kg to 630-kg beam-balance manipulators with electric, pneumatic and hydraulic actuators.

The beam-balance manipulator features which determine their extensive use at enterprises of the Mintyazhmash and other ministries — load rigidly secured to the manipulator gripper, broad range of speed, combined load gripper and crank, partial automation of the transfer process — permit a reduction in materials-handling time, improved operator working conditions, and protection of the technological equipment.

The indicated type of machine is being widely used to load technological equipment, mainly metalworking, and to unload transport (floor and overhead conveyors) when loading pallets and crates.

The speaker included among the shortcomings of this type of manipulator the comparatively unsophisticated technical level of a number of the actuator electric and hydraulic drive assembly components and reliability indicators inferior to those of the best models.

The institute has developed and submitted for production 50- and 320-kg robots designed to automate the loading and unloading of overhead conveyors and the transfer of items to process equipment loading positions.

An experimental 320-kg modular industrial gantry industrial robot for transferring items to equipment in the shop area is now being tested, the speaker said.

All the indicated types of robots and manipulators are included in the list of equipment designed for use in FMS.

S. P. Moiseyev, deputy chairman of the "Industrial Robots" section of the Council to Assist Scientific-Technical Progress attached to the Krasnoyarsk CPSU kraykom, spoke on the problems of creating and introducing robot equipment complexes at enterprises of Krasnoyarskiy Kray.

B. S. Vidrevich, scientific associate at the "Soyuztsvetmetavtomatika" NPO [scientific-production association], spoke on the use of industrial robots in organizations of the Ministry of Nonferrous Metallurgy.

One of the main areas in which low-skill manual labor is being reduced in nonferrous metallurgy is the automation of basic technological and auxiliary processes based on the use of industrial robots and robotized technological complexes, the speaker said. At the same time, branch features, which were briefly described, demand both the development of a broad range of specialized industrial robots and maximum use of multipurpose, series-produced robots.

In this connection, the branch is working to develop industrial robots specialized to take pulp samples, automatically measure the thickness of rolled metal, and so on, and to widely introduce multipurpose industrial robots already in production. Such industrial robots are used in "traditional" operations such as servicing presses and metal-cutting machine tools, machining nonferrous metals, and in hard-alloy and electrode production.

They can also be used in such specific operations as removing the oxide film when pouring metal into ingots and in sharpening drill bits.

However, in order to fully meet the demands of nonferrous metallurgy, we also need mobile anthropomorphic industrial robots with load capacities of up to 100 kg and interactive robots with load capacities of 100-1,000 kg; vision systems and tactile analyzers are needed in 38 percent of the cases, and heat and chemical stability and dust and moisture protection are needed in 72 percent.

The branch automation problem therefore involves a number of stages, the speaker said: choosing an optimum way of automating robotization objects, then shaping the technical requirements for using series-produced industrial robots and robotized technological complexes or developing specialized ones.

In order to automate the basic technological and auxiliary processes as quickly as possible in the 12th Five-Year Plan, the branch will be cooperating

on robotics with organizations in other ministries and departments, as well as with CEMA member-nation organizations.

A decision made at the enlarged meeting noted that implementation of the CPSU Central Committee and USSR Council of Ministers Decree "On Steps to Accelerate Scientific-Technical Progress in the National Economy" and the lines indicated by the 27th CPSU Congress include:

- implementation of a comprehensive program to solve the scientific-technical problem of "Creating and Mastering Industrial Robots in 1981-1990";
- implementation of a program for comprehensive industrial robot standardization in the USSR and CEMA member-nations.

Development of state standards for unit-module IR which establish the type and basic parameters of individual units and actuating mechanisms began in 1986.

A special "Standardization of Test Methods and Means" section of the program for comprehensive standardization of industrial robots is in the development stage.

The assignments of this section anticipate standardizing IR and IR component test methods, including accelerated reliability testing, standardizing the means and methods of software-information support for robot equipment testing, and standardizing the basic types of test equipment.

The meeting noted that industrial robots are currently used widely in various branches of our national economy. However, the effectiveness of their use is reduced by the incompatibility of robots and NC machine tools, by poor component unitization, and by the poor reliability of electronic control devices.

The reliability of industrial robots is negatively affected by technological discipline violations leading to gross production defects, as well as by inadequate testing, both at the enterprises producing the robots and robot equipment complexes and at the suppliers of electronic and electrical assembly components.

The servicing system and the skills of servicing personnel also play a considerable role in ensuring the effectiveness of IR and robotized technological complex use.

The resolution noted that the intensive development of productive forces in Krasnoyarskiy Kray, with its priority on machine-building branches, and the critical shortage of human resources determine the necessity of creating industrial robots and FMS and using them extensively at kray enterprises and the necessity of training personnel and conducting scientific research in this area.

Meeting participants focused attention on the inadequate rates of development of metrological support programs for IR production and operation (responsible developer -- "Sistema" NPO) and the unsatisfactory Minstankoprom efforts to create a system of state IR testing. This ministry has thus far failed to approve a lead organization for state IR and RTC testing in the branch.

To further develop work on standardizing industrial robot engineering, the Gosstandart Scientific-Technical Council recommended the following primary areas of work on standardization and unitization in the area of industrial robot engineering in the 12th Five-Year Plan:

- development of a system of unit-module IR and RTC construction and normative-methods support for it;
- development of and improvement in methods of setting standard specifications, including productivity and reliability, with a view towards their operating as part of robot equipment complexes and technological lines;
- creation of a system of state tests for IR and assembly components for them, including work to standardize and unitize test methods and means;
- metrological support for IR development, manufacture and operation.

It recognizes the necessity of:

- including in the 1987-88 standardization work plan the creation of normative-technical documents regulating the methods of evaluating the accuracy and reliability of IR test results and regulations for confirming test requirements, in order to ensure the objectiveness of evaluations of the technical level and quality of industrial robots;
- making an expert scientific-technical evaluation of standard programs and methods of state IR testing at the VNIINMASH, based on theoretical and experimental research aimed at ensuring unity in testing and reproducibility of the results obtained;
- development by the "ENIMS" NPO of a draft complete list of IR malfunction and limiting-states criteria.

It is recommended that a working group consisting of "ENIMS" NPO, MAI, TSNIIRTK and VNIINMASH specialists be created to develop accelerated IR reliability testing methods in 1987.

It is proposed that the TSNIIRTK, INMASH AN SSSR, "ENIMS" NPO and "VNIIM imeni Mendeleyeva" NPO make suggestions in 1987 on the make-up of a basic set of standard apparatus for monitoring IR parameters at the production stage, in order to ensure the collection of information on the quality of industrial robot manufacturing.

It is recommended that the USSR Ministry of Higher and Secondary Special Education examine the question of creating a "robotics" specialty in higher technical academic institutions and that the industrial ministries set up special courses in the skill-improvement system to train specialists to trouble-shoot robot equipment. Moreover, the appropriateness of creating special worker and engineering-technical personnel schools for servicing robot equipment in the major industrial regions at associations and institutions of higher education is also noted.

A number of recommendations were aimed at solving the labor resources problem in Krasnoyarsk Kray industry. In particular, it is proposed that the USSR Academy of Sciences and USSR Minvuz examine the question of opening a regional study-methods center for robot equipment and flexible manufacturing systems in Krasnoyarsk to coordinate and conduct scientific-methods work on training and improving the skills of specialists in this field and that the RSFSR Minvuz

examine the question of opening up a TsNIIrobototekhnika [central scientific research institute of robotics] and Technical Cybernetics branch of Krasnoyarsk Polytechnical Institute to coordinate the development, production and operation of IR and FMS in the region.

It is recommended that the Minstankoprom examine the question of creating a regional Krasnoyarsk center for trouble-shooting, starting up and warranty service on NC equipment.

With the goal of developing the section on unit-module IR it is proposed that the Gosstandart's Administration of Machine Tool Industry and Interbranch Production Facilities change the industrial-robot PKS [not further identified] to reflect the suggestions of the machine-building ministries.

In order to resolve the question of NTO participation in implementing robot equipment standardization, it is recommended that the VSNTU [All-Union Council of Scientific and Technical Societies] Committee on Automating and Mechanizing Production Processes, jointly with the Coordination Council of NTO Organizations for Standardization and Quality Questions, develop their own proposals on this question and submit them to the VSNTU Presidium and Gosstandart prior to the end of 1986.

Resolution approved by Gosstandart chairman G. D. Kolmogorov.

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INTRODUCING COMPUTER-AIDED WRITING OF CONTROL PROGRAM SOFTWARE FOR NC MACHINE TOOLS

Moscow STANKI I INSTRUMENT in Russian No 1, Jan 87 pp 27-28

[Article by P.C. Shistko]

[Abstract] All available computer-aided systems for writing control program software for NC machine tools have some deficiencies which limit their scope or lower their effectiveness in small-scale and custom production. An analysis of the causes has revealed a way to optimize the software for this application. The cost of solving a problem of medium complexity has been analyzed for the purpose of its minimization, this cost being treated as a function of the number of machining stations. A comparative cost evaluation of several program preparation variants, using a different computer each, indicates the most expedient variant for any given machine tool. A special-purpose operating system with software written in BASIC has been developed by following this procedure, with appropriate data retrieval and mnemonic text editing, which is compatible with an SM-4 minicomputer and an Elektronika 100-25 microcomputer in terms of simplicity and reliability. It can operate with magnetic tapes as well as with magnetic disks. It increases the productivity of an engineer-programmer by a factor of 2.5 and is over 10 times more productive than manual program preparation. Figures 2.

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METHOD OF MAKING ROBOTIZED TECHNOLOGICAL SYSTEMS MORE EFFICIENT

Moscow STANKI I INSTRUMENT in Russian No 1, Jan 87 pp 4-6

[Article by M.B. Nakhov]

[Abstract] A simulation program has been written in the GPSS language for design and performance analysis, including cost analysis, of industrial robotized technological systems by any YeS computer. The variables here are operating time of controlled machine tools, length of robot's operating cycle,

type of production, equipment resetting time, magazine capacity, mean time between machine tool and robot failures, and repair time referred to failure-free operating time. Experiments with this model have revealed that under any given conditions the load factor on an attending operator depends largely on the number of machine tools in the robotized system and on the ratio of repair time to failure-free operating time. Cost analysis of increasing the number of attending operators in one robotized system, which will increase the system productivity by reducing the total resetting time and total fault clearing time, must take into account additional capital outlay for facilities and additional wages for labor. The results of such an analysis indicate the optimum labor organization which will increase the system productivity most economically. The results of such an analysis pertaining to a robotized technological system which includes three mod. 1V340F30 lathes for parts weighing up to 10, 40, and 160 kg, respectively, indicate that team attendance increases the cost effectiveness of such a system by reducing the total idle time, this cost effectiveness increasing as more robots are combined for attendance by a single team. The higher the equipment cost and the longer the repair time are, the more advantageous will be team attendance. Figures 1; tables 2; references 4: all Russian.

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UDC 62-83-82

IMPROVING CHARACTERISTICS OF ELECTROHYDRAULIC SERVOMECHANISMS WITH RELAY CONTROL

Moscow STANKI I INSTRUMENT in Russian No 1, Jan 87 pp 10-12

[Article by V.V. Gromov]

[Abstract] Transient characteristics of electrohydraulic servomechanisms for drilling-riveting and welding tools are analyzed by the methods of transfer functions and harmonic linearization, for a comparative evaluation of proportional and relay controls, on the basis of the corresponding equivalent structural diagrams. In the case of proportional control minimizing the effect of gaps in a system with mechanically not very stiff components requires reduction of the gain and thus degrading its static as well as dynamic characteristics. In the case of relay control, widening the forbidden zones and shifting them relative to the steady-state amplitude-phase characteristic allows minimizing the effect of gaps while maintaining the required transient response characteristics. These theoretical conclusions have been verified experimentally in a special test stand, in which proportional control was slightly improved by adding a linear integrating member and positioning precision was improved by adding a relay with a dead zone. Figures 5; tables 1; references 2: Russian.

2415/13046
CSO: 1862/105

SIX-AXIS UNIVERSAL ROBOT DEVELOPED IN RIGA

Moscow PRAVDA in Russian 23 Dec 86 p 1

[Article by O. Meshkov, under the heading "On the Scene": "Six Degrees"]

[Text] The Riga Industrial Robots Plant is just being built. Even its first line is not fully operational yet. But products are already coming off the conveyor. What products? As the year ends, they are making the first multipurpose robot to possess an amazing six degrees of freedom, as the specialists say.

Here it is, actually built, the height of a tall man, ochre-colored. It stands modestly, off to the side, a steel arm raised as if in greeting. Plant chief engineer A. Sokolov tells us what this product is capable of. Six degrees of robot freedom means six different movements its gripper is capable of, like the fingers, wrist, whole arm, and even the body. The movements are made at practically any point within reach. Furthermore, the robot can lift up to 15 kg.

"And what's its job?"

"It has several," Anatoliy Platonovich explains. "The robot can be used for mechanical assembly, to monitor welds, for grinding, stamping, and several other operations."

I see two metal boxes next to it. They turn out to be an electronic computer, the control system, the robot's brains. It should be noted that a Minsk plant makes these systems.

"This means you are consolidating construction of the robots with Minsk workers?"

"Quite correct," the chief engineer answers. "However, the system they provide is not exactly what we want, although it's a good one. It's designed for very different robots. Our design bureau has a group of specialists, led by A. Korobko and A. Yanelinus, which is modifying the Minsk system to take into account the specifics of our multipurpose robot."

As soon as one begins talking about designers, it should be noted that they are all young and spirited. The plant leadership tries to support the creative initiative of young people in every way possible. When they came to work on this multipurpose robot, they were assigned to a newly-created initiative creative group. This helped save valuable time by avoiding various plan reconciliations and correspondence, in a word, paperwork. The job was reduced to "draw it and build it."

"The results have been good," says designer and project leader S. Zaytsev. "It took just nine months to create our robot, from the first lines on the drawing board to the instant it came to life in metal. I say "just" nine months because this work ordinarily takes two or three years."

The plant is just taking the first steps, but its output is known throughout the country. It also manufactures huge robots capable of lifting 120 kg and tiny ones which can lift only 90 grams.

One can see out the director's office window a new construction site for an enormous production shop which will stockpile the multipurpose robots. A prototype of the plants of the future is being born.

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ROBOT ENGINEERING INTEGRATED TRAINER-SIMULATOR

Moscow MASHINOSTROITEL in Russian No 1, Jan 87 pp 13-14

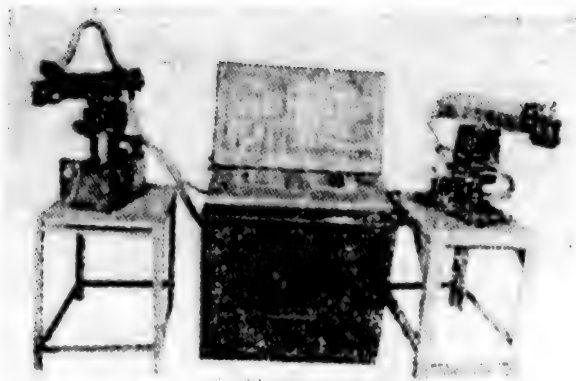
[Article by V.D. Darovskikh, engineer]

[Text] The innovative organization of engineer training at Frunze Polytechnical Institute has facilitated the intensive development of numerous original solutions in robot engineering in the Kirgiz SSR. Institute associates also pass on their pedagogical experience in teaching production technology, automation and robotization to tekhnikum and SPTU [special vocational-technical school] teachers, also giving them training and laboratory experience.

The dissemination of advanced ideas and the influx of specialists into production has had an effect, foremost on heightening interest among progressive developers at republic enterprises, which have set up special automated design systems subdivisions and subdivisions for introducing robots, flexible manufacturing systems and computers.

The wealth of modern equipment in the shops and sectors has enabled the polytechnical institute to set up laboratories right at the base enterprises and, in so doing, to improve methods of teaching special disciplines. The development of these methods has shown that equipping the laboratory with simplified technical devices with message redundancy is a sensible line of effort. After all, automation devices, and robotization devices in particular, can be depicted schematically, regardless of complexity, and this, coupled with controllable indicators and pointers and transformed into a so-called mimic panel, is a successful resolution of the training task. By combining a mimic panel and a mock-up of the actual machine into an integrated unit, one has a trainer for developing professional habits.

As an example, let's look at a simulation training system complex for practical and laboratory exercises in the disciplines, exercises based on studying the components of manipulation mechanisms, devices for controlling them, and programming techniques and methods. It differs from known multipurpose complexes in the nature of its construction, in its comprehensive visual depiction of information and logic control functions, and in its possible industrial application to automate specific processes.



The simulation complex consists of an information unit and two manipulators, models RF-1 and RF-2, with grippers. The information unit is hooked up to a dual power supply: compressed air ($p = 0.2 \dots 0.5$ MPa) and a.c. ($U = 220$ V, $f = 50$ Hz). The manipulator target mechanisms are also connected to the information unit by power cables.

The operator interacts with the manipulator mechanisms through the information unit, which is ergonomically designed and contains power supply, distribution, control and air compressor. The distribution unit is functionally linked to the air compressor and control units and to the control panel. The air compressor and distribution units contain additional control panels on the front, for adjusting the absolute operating pressure values in the pneumatic system and for manual control of the pneumatic distributors. The distribution unit also anticipates outlets for connecting specific manipulator target mechanisms.

The front panel of the information unit contains two mimic panels with logic information indicator lights, a control panel and the program media. The mimic panels depict the manipulator's pneumokinematic circuits in three levels: manipulator and gripper actuating mechanisms; electromagnetically-controlled distribution units; the air compressor with dehumidifier and dust collector, oil splasher, and pressure regulator and relay. The lights are built into the circuits of the manipulator and gripper target mechanisms, distributors and power supplies. This allows recording and correlating the status of the mechanisms and the devices controlling them.

The control panel has manual and automatic program media information read-out and can switch to any of the mimic panels in sequence, adjust the frequency with which the control pulses are issued, and program the last cycle.

The simulator is used to study the design and circuitry of original manipulator mechanisms and modular-type grippers, programmed control systems and power supply sources; develop methods of programming the work cycle; seek out resolutions to practical technological tasks; study the performance of installation, debugging and adjustment tasks, testing and certification; synthesizing various control circuits; kinematic and dynamic studies; and developing recommendations on improving designs.

This first robot equipment simulator, developed at FPI [Frunze Polytechnical Institute], is popular with both teachers and students, and Frunze SPTU students have taken it upon themselves to manufacture several simulators. Robot equipment elements are also being manufactured by schoolchildren at Young Technician Stations, where they are mastering the fundamentals of engineering activity. Conditions are thus being created for training various levels of specialists for Kirgizia machine-building enterprises on a unified methods basis.

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TARGET PROGRAM FOR INTRODUCING INDUSTRIAL ROBOTS AND RTK

Moscow MASHINOSTROITEL in Russian No 1, Jan 87 pp 11-12

[Article by B.V. Vashnitskiy under the heading "Production Mechanization and Automation"]

[Text] Jointly with the branch NTO [scientific-technical society] boards and the territorial robotization center, the Kiev city committee of the machine-building and instrument-making workers' trade union has been implementing the Target Comprehensive Program for Creating and Introducing Industrial Robots and Robot Equipment Complexes (RTK) in 1982-1986. A savings of 1.3 million rubles and the release of 270 workers for other jobs were achieved in the 11th Five-Year Plan as a result of the introduction of robots at Kiev enterprises. During the first nine months of 1986, the branch introduced 10 mechanized flow lines, eight automated sectors, and more than 90 new technological processes. Introduction of automation and mechanization equipment did much to facilitate the fact that the proportion of manual labor at Kiev Minstankoprom [Ministry of Machine Tool and Tool Building Industry] enterprises was 29.2 percent in 1985 (29.7 percent at Minlegpishchemash [Ministry of Machine Building for Light and Food Industry and Household Appliances] enterprises in Kiev and 31.8 percent for Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems] enterprises in Kiev).

With a view towards introducing robot equipment and increasing the effectiveness with which it is used as quickly as possible, the city board of the instrument-making industry NTO and the trade-union city committee have jointly worked out methods recommendations and sample terms for setting up target socialist competition among enterprise collectives.

By participating actively in the socialist competition, enterprise labor collectives have done much to create robots and introduce them into production, to raise the level of automation and mechanization, and to reduce the proportion of manual labor. Thus, for example, the "Tochelektropribor" PO [production association] introduced 82 robots in 1985 alone and 243 over the five-year period. This enabled the printed assembly board electroplating and copper-plating sectors to fully automate processes with hazardous working conditions. The tool shop at this enterprise has repeatedly been among the top three in the socialist competition to introduce robot equipment.

Certain successes have been achieved in introducing robot equipment at the analytical instruments plant. It introduced a mechanized polymer coatings line and two mechanized plating lines, and in 1985 alone it incorporated 37 robots. Enterprise workers, engineering-technical personnel and employees took a very active part in it, and their personal creative plans reflected robot equipment introduction issues.

The association's stamping shop created a model robotized stamping sector consisting of nine industrial robots and equipment for them. A creative brigade was organized to solve problems involving the introduction of robots into assembly production. It robotized the assembly of lens barrels, lenses, condensers and film strip projector knobs. The resulting savings was 43,900 rubles, and 12 people were hypothetically freed for other jobs.

At the Kiev Machine Tool Manufacturing PO, much attention was paid to implementing the "Manual Labor" program. It introduced an MPU-17 automated rolled-metal cutting sector, an AKPA-1235 automated press-forging complex, and three automated electroplating lines.

The "Elektronmash" PO imeni V.I. Lenin collective has also achieved great success in this area. In 1985 alone, the association introduced 130 robots and manipulators. Using an operative robotization group and a "Production Automation, Mechanization and Robotization" section working under the NTO council, it created a comprehensively mechanized sector, equipped with two mechanized flow lines, for chemically plating multilayer printed circuit boards; it introduced four plant technical management automation systems; it manufactured and introduced a set of mechanized and automated equipment to produce felt-tipped pens; it introduced robot equipment complexes to install integrated circuits on printed assembly boards. As a result, printed circuit board quality was improved, the throughput of the plating lines was increased by 20 percent, stamping and plating work was easier and labor productivity rose in assembly production and when consumer goods were produced.

The collectives of other branch enterprises also achieved certain successes.

The city board of the instrument-making NTO has taken a number of specific organizational steps to involve the instrument-manufacturing scientific and technical community in solving pressing problems of production mechanization and automation.

Thus, a "Robot Technological Systems" section was created by the city board and six NTO primary organizations were created to monitor progress in implementing the branch program for introducing robot equipment at branch enterprises. Progress reports are presented regularly at meetings of the board presidium and a board plenary field session was held on this subject at the "Elektronmash" PO.

An annual public review of the work of the scientific and technical community has been held since 1983 to reduce the time involved in introducing robot equipment at Kiev instrument-manufacturing enterprises. The fact that 17 agreements on creative cooperation in introducing robot equipment into production were concluded in 1985 alone in the course of this review indicates

its effectiveness. The creation of creative brigades comprised of engineers, designers, technologists, electronics technicians and operators facilitated reducing the time involved in introducing them. Brigades of this kind are working successfully in the "Veda" PO and at the analytical instruments plant. Characteristically, it was these very enterprises which were on top in the 1985 review: the analytical instruments plant collective came in first, the "Veda" PO collective came in second, and the "Elektronmash" PO collective came in third.

Specialized contests also helped increase the creative initiative of the scientific-technical community. Thus, a contest for best production mechanization and automation has been held annually since 1982 on the initiative of the trade-union city committee and the instrument-making NTO board. It should be noted that a large number of the works submitted in the contest have been devoted to the development of robot equipment and its introduction into production. These have been among the most interesting: a robot equipment complex permitting automation of the installation of circuits on printed boards (at a rate of 2,000 circuits per hour; 60 different types of microcircuits) and an annual savings of upwards of 60,000 rubles; a robot equipment complex for manufacturing IP8 23006 flanges out of rod, providing an opportunity to automate and combine seven transitions, hypothetically freeing four people and some multipurpose equipment for other work (the RTK is serviced by a single trouble-shooter), and resulting in a savings of 42,400 rubles; a local flexible manufacturing modules control network and interpreters for preparing technical cycles, with an economic impact of 245,000 rubles. In this regard, equipment readjustment time was reduced five-fold.

In 1985, "Elektroprigor" held a contest for best proposal on mechanizing and automating labor processes and lowering the labor-intensiveness of output in production. Nineteen proposals were received during the review, and the economic impact of introducing them exceeded 22,000 rubles.

Exchanging leading production experience is an important area of work in the scientific-technical community. A catalog of robot equipment by type of production, indicating the economic and social impact of its introduction, was developed on the basis of an analysis of the effectiveness of introducing robot equipment at Kiev instrument-making enterprises. The republic holds seminars for specialists in the scientific-technical community at least 2-3 times a year. In 1986, for example, it held seminars on "Problems of Developing Photoelectronic Robot Vision Systems" and "Systems for Automated Flexible Manufacturing Facility Design."

Inventors, efficiency specialists and production innovators make a substantial contribution to mechanizing manual labor. In the 11th Five-Year Plan, 355 inventions and about 15,000 efficiency proposals were introduced into production, hypothetically freeing about 1,000 workers.

This was greatly facilitated by stations set up by the VOIR [All-Union Society of Inventors and Efficiency Experts] council to monitor the development and use of inventions and efficiency proposals aimed at mechanizing hard manual and auxiliary jobs, as well as by the special-topic contests, relay races and reviews held at the enterprises.

All branch enterprises have created young efficiency expert schools and operate "Idea Trade Fair" clubs for young people, where young specialists receive homework assignments on solving production automation and mechanization problems, in order to involve young people in creative invention.

This five-year plan, the labor collectives of Kiev machine-building and instrument-making enterprises have been set serious tasks concerning reducing the proportion of manual labor in the branch. The intention is to introduce 433 robots and 43 flexible manufacturing modules and systems, which will free more than 800 people for other work, save 2.8 million rubles, and reduce the proportion of manual labor to 20 percent.

It may be confidently stated that these tasks will be carried out.

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CMEA 'INTERROBOT': INITIAL STEPS

Moscow NEW TIMES in English No 10, 16 Mar 87 pp 24-26

[Interview with Igor Ordinartsev and Vitali Tsarenko by Yuriy Samoilov]

[Text] Robots have aroused more controversy than any other development in technology. Their failure to bring about the breakthrough expected of them in production has cooled many robotics enthusiasts off. Some have even come to deny the usefulness of robots altogether. Nevertheless, the Council for Mutual Economic Assistance decided, at its 41st session in late 1985, to establish the Interrobot international research and production amalgamation. Igor Ordinartsev, first deputy Minister of the Machine and Tool-Making Industry of the U.S.S.R., and Vitali Tsarenko, chairman of the board of Interrobot, discuss the problems facing the amalgamation in the following interview to journalist Yuriy Samoilov, Cad. Sc. (Tech.).

[Question] The French weekly Le Nouvel Observateur points out that in 1985 demand for industrial robots on the world market was 50 percent up on the 1984 figures, while in 1986 it was only 5 percent more than in 1985. Many computer manufacturers have sustained losses. How would you explain this decline?

[I. Ordinartsev] Today the world is taking a more sober view of the potential of industrial robots and, more importantly, of the principles underlying their utilization.

A robot is not a TV set where you merely push a button to switch it on. A robot must be adjusted to--or "mated with," to use a technical term--a certain type of a machine tool. And this is no easy matter. This is why the emphasis is now on introducing the so-called robotic complexes, or flexible production modules, each comprising a machine tool and a robot. Incidentally, these modules can be put together to make up flexible production systems.

[V. Tsarenko] There are several reasons for this plummeting in demand. Firstly, most prospective users are inadequately informed about the capabilities of industrial robots; secondly, robots are rather expensive and take some time to pay for themselves; and thirdly, putting a robot to industrial use usually involves several readjustments on the factory floor. Last but not least, many flexible production systems (comprising a machine tool, a

conveyance facility and a control system) can do perfectly well with simpler and cheaper means of positioning components on a machine tool.

[Question] Don't you think that such a reduction in demand for robots will tell on the activity of Interrobot?

[V. Tsarenko] No, it won't. This reduction is temporary. There'll be an ever greater need for robots and robotic complexes all over the world.

[I. Ordinartsev] We get many orders for robotic systems and individual robots from various industries in the U.S.S.R. The same is true of other CMEA countries. The point is that robots can take over monotonous, tiring, hazardous and night-time jobs. Therefore, Interrobot is a very useful organization, and every effort must be made to promote its work.

[Question] What was the Soviet Union's objective in helping establish Interrobot?

[I. Ordinartsev] Robotics engenders a whole complex of scientific and technical problems which even a large country like the U.S.S.R. can hardly cope with on its own. The solution of these problems lies in the international division of labor and standardization.

[Question] Does this mean that the U.S.S.R. is lagging behind other industrialized countries in developing robots that measure up to the highest world standards?

[I. Ordinartsev] To a certain extent it does. The range of robots we produce falls short of that available on the world market, and the quality of our robots leaves much to be desired as compared with the best foreign makes.

Moreover, the very pattern of our robot output, and the relative quantities of the types we produce are wrong. Specifically, we make too few of the so-called industrial robots, i.e., those intended for painting, welding and assembly jobs, and too many service robots, which can be used only as complements to industrial equipment.

The problem now is not only to extend the range of the robots we make, but also to standardize them, i.e., to make them cheaper. This will make them applicable to a wider variety of uses.

[Question] How are you going to achieve this?

[I. Ordinartsev] By making new robots of standardized and modular designs. The robots' "hands," "joints," drives, transmissions and controls are to be standardized so that they can perform different operations. Instead of highly specialized robots, we shall concentrate on making individual structural elements, or "building blocks," which can be assembled into multipurpose robots. If we succeed in rectifying CMEA standards and bringing them into conformity with international ones, we shall achieve better international standardization.

[V. Tsarenko] Our prime task is to improve the quality and enhance the reliability of the robots and of all their components. An international center is being set up within the framework of Interrobot for the purpose, whose chief function will be to test robots. If a model fails to conform to a specific technical standard, it will be returned to the manufacturer. This practice spares numerous robot users the need to do their own testing.

[Question] These are splendid plans, but are you sure they'll be carried out? This isn't the first time that the desire to make better robots is proclaimed.

[V. Tsarenko] The January 1987 plenary meeting of the CPSU Central Committee pointed out that our research and development efforts failed to meet the requirements of the national economy. Some R&D bodies were concentrating on modifying the models already in use rather than creating entirely new ones. Is it any wonder therefore that even our so-called "new" equipment often failed to compete on the world market? In developing machines--robots in particular--today, we seek to match the international standards. Can we do so? The record of our brilliant achievement in aircraft and rocket construction and in other fields makes us certain that we can do no worse in robotics very soon.

[Question] At all the robot-equipped factories I have visited, operatives complain of the slowness, inadequate precision, low interference resistance and unreliability of their steel helpers. Moreover, robots are fairly expensive. The question arises: wouldn't it be better to stop making such robots and concentrate on developing better models?

[I. Ordinartsev] I don't altogether agree. How can we make further progress without producing and using robotic complexes on a sufficiently wide scale? After all, you can't learn to drive a car without actually doing so, albeit inexpertly at first. It may be that the complexes are far from perfect in the early stages. What matters is to gain experience in handling these complex machines, which call for considerable readjustments in manufacturing patterns. The robot is to become as common a means of industrial production as the machine tool is today. It is also bound to find its way into classrooms at all higher and secondary technical schools.

Technological progress and the improvement of equipment operation techniques are two mutually complementary and interdependent processes.

Separate "service" robots not teamed up with machine tools, presses or other items of industrial equipment are another matter. Their output must indeed be reduced radically because they are not of much use except as fashionable attributes of progress; more often than not they are brought onto the factory floor by an error in planning.

[Question] This brings to mind the fate of the plastic heart which has been given up as a bad job after a number of implantation failures. Efforts are now being made to design a more reliable artificial heart. In the meantime, heart cases are being kept alive by substituting artificial valves for their

worn-out ones and by heart transplants. Couldn't the same tactic be adopted in automating industrial production by using cheaper and more reliable substitutes for the expensive, complex and clumsy jumbo robots one sometimes sees on the factory floor today? I wonder how many kindergartens and homes could have been built instead of the tens of thousands of primitive robots we have produced over the past 10-15 years, and how much more it will still cost us to overcome this mental inertia? As you certainly know, robots often bring factories nothing but losses.

[I. Ordinartsev] To draw another parallel with a TV set—why buy a model on sale today if a more reliable and compact one is coming tomorrow?

This, however, is not the approach to be taken to technological progress. One can wait forever for an 'ideal product. Robotics is a major trend in economic advance, and we must promote it in every way for our own good. You don't install new-generation equipment simply to follow the fashion, you do it for economic reasons. The surest way to discredit any technical innovation or any new form of work organization is to misuse it. Factory managers should find the space for and decide on the most rewarding use of robots before, and not after, buying this very expensive equipment. If a robot works only intermittently rather than a six-day week on a two- or three-shift basis, it will never pay its way.

Although man is incomparably more intelligent and adaptable than a robot, it wouldn't occur to anyone to entrust the operation of a sophisticated machine tool to worker picked at random. The job requires special skill acquired through long training. Therefore, the solution to the problem of introducing robots on a large scale lies in ensuring their reliability and making proper use of them as components of complexes designed expressly to discharge definite functions.

[Question] Speaking of difficulties, does Interrobot confront any?

[I. Ordinartsev] It certainly does. There are the problems associated with attaining maximum efficiency, selecting the optimum development strategy, standardization and long-term planning. Robots cannot decide on their own what roles they are to play in production process. These decisions are made by man.

[Question] Besides the U.S.S.R., Poland, Bulgaria, Hungary, Cuba and Czechoslovakia belong to Interrobot. Why haven't the G.D.R. and Romania joined it?

[V. Tsarenko] Ours is a voluntary organization, of course, and open to all countries. I am sure the two states you have named will also soon join it.

[Question] Some may think Interrobot a closed organization.

[I. Ordinartsev] Nothing could be further from the truth. We are not going to solve our problems within the confines of this organization. Although it is supposed to cater to the needs of the CMEA member states, some of its products--robot complexes, for the most part--will be supplied to the world market.

[Question] What, in your opinion, are Interrobot's advantages over bilateral organizations, like the Soviet-Czechoslovak Robot Association?

[V. Tsarenko] It should be borne in mind that Interrobot's program provides for specific projects to be carried out under contracts. This imposes much greater responsibility on the participating states. As for the Robot Association, it is a member of Interrobot, and its plans dovetail with ours.

[Question] Will other such associations be formed within the framework of Interrobot?

[V. Tsarenko] So far no plans are afoot for the establishment of such associations concerned with robotic complexes. Nevertheless, temporary working bodies will be formed in the context of bilateral cooperation between factories. The Soviet research and production amalgamation Varnish-and-Paint Coating, for instance, is to cooperate with the Materials Protection Institute (Czechoslovakia) in developing automated coating application equipment. The Mukachevo machine tool plant and the Soviet-Czechoslovak Robot Association are to join hands in designing robot machine tool operators. This is a most promising form of cooperation, and I am sure new ones will emerge spontaneously in the future.

[Question] Socialist countries have lately been embarking on joint ventures with the capitalist world's leading manufacturers of robots and other automatic systems. The cases in point are the Bulgarian-Japanese Fanuc-Machinex firm for servicing Japanese numerically controlled devices and robots in European CMEA member states, Yugoslavia, Greece and Turkey, and the Bulgarian-American firm Sistematica for the servicing and development of the automatic and control systems in the chemical industry. Similar firms will evidently be organized soon in cooperation with enterprises in CMEA states. Don't you think enterprises of socialist countries may eventually find it more profitable to do business with Western companies than to cooperate with each other in Interrobot?

[I. Ordinartsev] Any Western firm is interested only in selling what it has to offer, be it equipment, licenses or know-how, whereas Interrobot opens up the most rational way towards an integrated and unified system for the development and manufacture of robots.

[Question] Does Interrobot have a clear-cut or only a general idea of what it is going to do?

[V. Tsarenko] The Interrobot member states have agreed on a detailed program of action for the period of up to 1990. They are to develop and build a number of new and modified models of industrial robots for machining, casting, welding, assembly and other jobs, and all the accessories to them. Provisions have been made for working out standards and unified robot repair and maintenance systems. Each country's specializations have been agreed on. For instance, the U.S.S.R. is to specialize in metalworking and casting robots and complete control systems; Poland, in welding robots, electric drives and control systems.

[Question] As has already been mentioned, self-contained robots are no longer much in demand. Nevertheless, your answers suggest that Interrobot is going to continue making them.

[V. Tsarenko] Interrobot is not going to become "set in its ways." It will respond promptly to shifts in market demand. Its initial plans are already being corrected, with a view to broadening their scope. Interrobot may undertake to do complex jobs for the participating states such as developing robotic complexes and flexible production systems. The manufacture of self-contained robots was only a beginning.

[I. Ordinartsev] What's more, as we keep abreast of technological progress, we shall be able to give more attention to robots designed for agriculture, public catering, underwater research and other fields of activity. Here in the U.S.S. R. the Robot interbranch research and technological complex--Interrobot's head organization--is going to enlist the cooperation of Leningrad's Robotics and Technical Cybernetics Institute for the purpose. I hope our new products will be of interest to our partners.

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ABATEMENT OF SOUND DURING PASSAGE OF GAS THROUGH CONICAL PIPE JOINTS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: MASHINOSTROYENIYE in Russian
No 2, Feb 87 (manuscript received 10 Jun 86) pp 38-41

[Article by B.I. Borovskiy, doctor of technical sciences, A.I. Chucherov,
doctor of technical sciences, professor, and V.L. Khitrik, engineer]

[Abstract] The problem of lowering the sound level in pipe joints during passage of gas is solved analytically for diffusers whose cross-section increases as the square of the distance from the start of the joint, with rectangular or trapezoidal cross-section as well as circular. Analysis and solution of the equation of steady-state gas pressure fluctuations and resulting sound wave for a conical diffuser reveal that, in terms of sound proofing characteristics, such a diffuser is equivalent to an exponential one. It is simpler to design and produce, however, its sound proofing characteristics being improved by widening its angle and decreasing its length. Figures 1; references 2: Russian.

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FUTURE BIONICS APPLICATIONS IN CONSTRUCTION DISCUSSED

Moscow STROITELNAYA GAZETA in Russian 4 Mar 87 p 4

[Article by T. Korypayeva under the "Unique Projects" rubric: "Making Atlantis by Hand: Search for and Discovery of Architectural Bionics"]

[Text] Our ideas of the underwater city are generally associated with fantasy or fairy tales. A part amphibian and part human with gills or Mistress Marya landing in the underwater kingdom--fictitious heroes created by incessant writer's fantasy, by an eternal dream about a human might capable of conquering everything including the world ocean. This is undoubtedly connected with the human desire to unravel the great secrets of underwater worlds and to find our Atlantis.

Our correspondent spoke of such attempts with Yu. Lebedev, director of the Architectural Bionics Central Scientific Research and Experimental Design Laboratory of the Theory and History of Architecture Central Scientific Research Institute of the State Committee for Civil Construction and Architecture [Gosgrazhdanstroy]:

"Studying the ocean has recently become a real, economically founded necessity since research on the reserves of the Earth's natural riches has revealed that they are exhaustible. The conclusion is unequivocal--shifting the centers of obtaining useful minerals, oil for example, to the shelf zone of the world ocean.

"After going out into the ocean's shelf zone, scholars and operating personnel quickly understood that it was too early to rest on their laurels. One after another, a long line of problems emerged that needed to be solved as quickly as possible--problems connected with repair and accident situations on drilling rigs. Experience of this magnitude has never before and still does not exist.

"The following objections have been completely appropriate: and in the end, what about divers, bathyscaphes, underwater boats? Divers cannot work at depths from 500 to 600 meters, and bathyscaphes and underwater boats without human hands--all in all, means of moving under water, machines, aggregates--are expensive and energy-intensive.

"Hydrologists throughout the world are avidly working on this problem. A sectorwide program called Architectural and Structural Assimilation of the Ocean's Shelf Zone has been created in our country. Scholars of the member countries of the CEMA are taking part in its implementation.

"Underwater architecture, the creation of a human settlement at the bottom of the sea, is a task that is fully attainable in the near future. We must create a space, a habitat medium under water in which humans could live for an extended period.

"This must be a completely autonomous medium. A bubble made of semiconductive film has been created in a laboratory test. A human being was placed inside and lowered under water. He breathed there. Of course, in the given experiment they progressed primitively. But they will certainly proceed step by step from the simple to the complicated and will arrive at a real result. Nevertheless, these are the first steps."

"How can a medium with a normal atmosphere be created under water? What can be taken for an analogue? Is there one? What must a bubble's film be like to contain an entire underwater city?"

"There is an analogue. It is human and animal skin," asserts Yu. Lebedev. "Everyone knows that a shoe made of natural leather is incomparably better than one made of synthetic leather. Leather "works" as a semiconductor; air and oxygen enter the organism through it, but it does not let water pass through. The many pores of skin are very complicated technical devices, the most highly developed ventilators....All the cover tissues of plants, animals, and humans are semiconductors. And we are based on this bionic principle.

As early as 1970 I formulated the problem of a "breathing wall" in construction. Indeed organic materials--wood or brick "breathe," but concrete doesn't. But it can be made to breathe by the principle of air and gas exchange of living cellular devices."

"Good. Let's say there is a bubble. Oxygen enters directly from water. But can a cell film coating itself regulate the necessary amount of oxygen? And let's not forget that at a depth of 500 meters there are currents, pressure, and temperature drops....Can your film "work" under these conditions?"

"The equipment that we should create by the end of the century still seems fantastic to us," smiles Yuriy Sergeyevich. "I think that the answer to these and many other questions will be whispered to us by living marine organisms (hydrobionites). We are studying the mechanics of their habitation in water, their interdependence upon one another, and the biologic and physical laws of their lives. They must be examined through "special" eyes; for example, how they process oxygen with gills...

"Architectural bionics is located at the juncture of two sciences. Sometimes we advance proposals and hypotheses that astonish biologists. We view things from unexpected points of view, study for another practical purpose. And at times this makes it possible to achieve a new result. We find the unknown in the long known. The main thing is to know how to formulate the problem."

"Well, Yuriy Sergeyevich, how do you intend to overcome Archimedes' law? Certainly your shell needs to be lowered to the bottom and fastened there?"

"It must be opened automatically, let's say like a parachute. Let's fantasize. We've found the optimal shape. It's an egg. The "collapsed" shell is brought to the bottom and secured. Here is another problem. Indeed they say "went to the bottom like a stone." How to lower the object quickly? What mechanism has helped living organisms develop great submersion speeds? It is undoubtedly related to the regulation of air ballast. But this is very complicated, and no one has studied it until now. Or take the maneuverability of fish....They can make 180-degree turns quickly....We only know that the animals' central nervous system regulates the turning mechanism.

"We have experience in creating "collapsed" houses. We made the first such home in 1982 for the North Pole-25 floating station. It is very compact, light (60 kg, 24 m² in unfolded form, and designed for six people). It is brought to the site in collapsed form, and two persons assemble it in 40 minutes. This is a storable, transformable structure. It can be folded into a plane. By prestressing it differently, we may obtain completely different architectural forms (it becomes instantaneously rigid on account of tightening with guy ropes). This home does not need either a foundation or support. It exists in and of itself. It stood in a wind of 40 m/s, and there have been no storms that have carried it away. The home's system is reminiscent of the human skeletomuscular system. It is elastic, and the laws of asymmetry localize loads in one place, while the other parts of the home don't experience them. This is already a reality."

"And what does your fantasy say about the links between an underwater settlement and the external world? You will agree that it was easier for Captain Nemo on his Nautilus?"

"You are correct. In our program there are fewer finished solutions than problems. We are hoping to create an elevator shaft, the basis of which will be the biologic system of a blade of grass. You know we have ganglia and interganglia. It is simpler to call these unique springs that damp vibrations and wind loads. Galileo said, 'A strong storm will destroy an oak tree, but a blade of grass will only bend in the wind and stand up again.' This is the optimal combination of elasticity and rigidity.

"In the ideal, our underwater structure should adapt to conditions of life in water as do living organisms. As little as possible should be expended on life support. This also means changing shape depending on mechanical and temperature loads, and the photosynthesis and cellular basis of the coating should be capable of sustaining pressure to thousands of atmospheres because each cell is prestressed with air or water and many more things as well.

"All these tasks are bionic and fully accomplishable. Another matter is more complicated--no one knows how to process human life support wastes in water. Of course marine organisms solve these problems automatically. They don't pollute the water in and of themselves because they live in a closed biologic cycle. Take the reed for example...They now plant it on the shores of the

Rhine. It turns out to be a splendid filter for water."

"Yuriy Sergeyevich, how long do you expect this unprecedented work to take? And certainly the result won't be integrated immediately?"

"The plan is to create a full-scale prototype of the size with a room 15 to 20 m² by the end of the five-year-plan, lower it to the bottom of a basin, and watch how it operates at corresponding loads. The following year we plan to make a very small model and test it in an aquarium. We have a lot of doubts. Only through full-scale tests will we be able to determine the correctness of our explorations and hypotheses. There are no precedents for this work.

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